

AD-AU98 236

TECHNOLOGY INC DAYTON OHIO

F/G 14/3

STRUCTURAL INTEGRITY RECORDING SYSTEM (SIRS) FOR U.S. ARMY AH-1--ETC(U)

MAR 81 J G DOTSON, A W KOLB

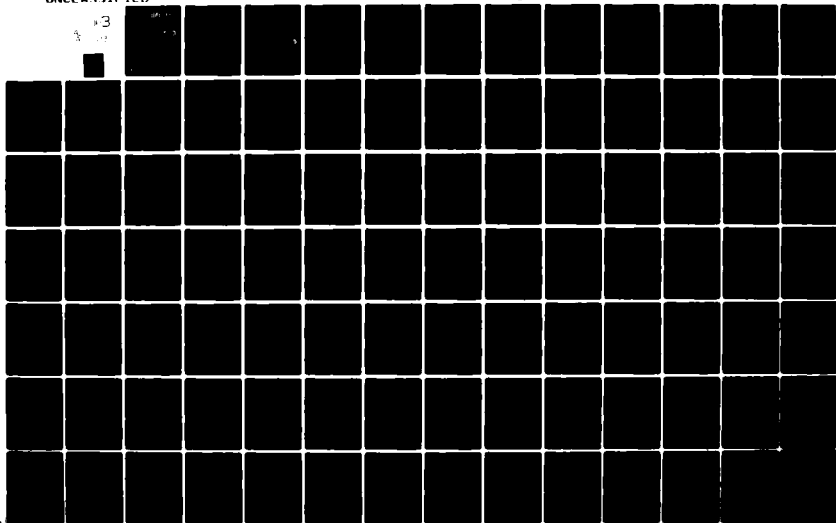
DAAJ02-77-C-0079

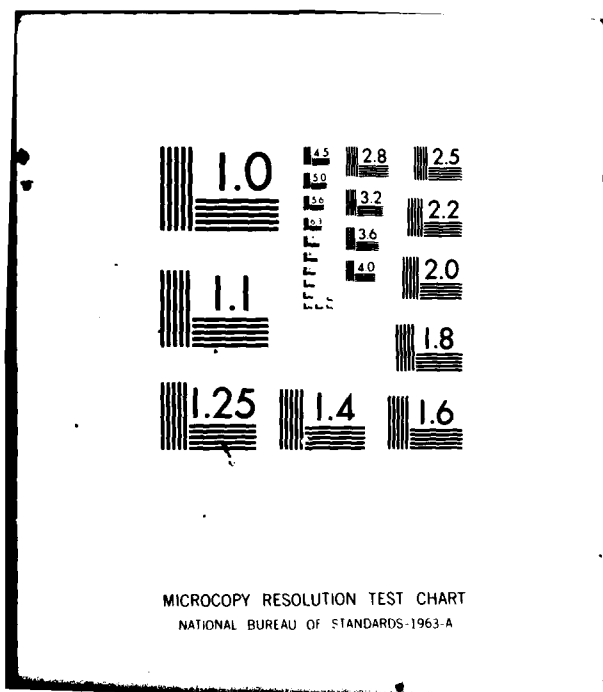
UNCLASSIFIED

USAAVRADCOM-TR-81-D-6

ML

3





USAAVRADCOM-TR-81-D-6

LEVEL



12

**STRUCTURAL INTEGRITY RECORDING SYSTEM (SIRS) FOR
U. S. ARMY AH-1S HELICOPTERS**

James G. Dotson, Axel W. Kolb
TECHNOLOGY INCORPORATED
Dayton, Ohio 45431

**DTIC
ELECTE
APR 27 1981**

AD A 098236

March 1981

Final Report for Period October 1977 - October 1980

Approved for public release;
distribution unlimited.

Prepared for

**APPLIED TECHNOLOGY LABORATORY
U. S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES (AVRADCOM)
Fort Eustis, Va. 23604**

ATC FILE COPY

81 4 27 000

APPLIED TECHNOLOGY LABORATORY POSITION STATEMENT

This report was prepared by Technology Incorporated under Contract DAAJ02-77-C-0079. The report documents the modification of hardware and software developed under Contract DAAJ02-75-C-0050 so that the SIRS could be used on the AH-1S helicopter. SIRS is a total system including a flight recorder, data retrieval unit, and computer software that permits calculation of dynamic component fatigue lives based on monitored flight condition spectrum of the AH-1G aircraft. Results of this program provided the design information and limited flight testing of an AH-1S SIRS system. Additional research and development is required to produce an operational system.

Duane M. Saylor of the Structures Technical Area, Aeronautical Technology Division, served as project engineer on this effort.

DISCLAIMERS

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission, to manufacture, use, or sell any patented invention that may in any way be related thereto.

Trade names cited in this report do not constitute an official endorsement or approval of the use of such commercial hardware or software.

DISPOSITION INSTRUCTIONS

Destroy this report when no longer needed. Do not return it to the originator.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER USAAVRADCOM TR-81-D-61 ✓	2. GOVT ACCESSION NO. AD-A098236	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) STRUCTURAL INTEGRITY RECORDING SYSTEM (SIRS) FOR U.S. Army AH-1S HELICOPTERS.		5. TYPE OF REPORT & PERIOD COVERED Final Report, October 1977 to October 1980
6. AUTHOR(s) James G. Dotson Axel W. Kolb		7. PERFORMING ORG. REPORT NUMBER
8. PERFORMING ORGANIZATION NAME AND ADDRESS Technology Incorporated Dayton, Ohio 45431		9. CONTRACT OR GRANT NUMBER(s) DAAJ02-77-C-0079 / NE2
10. CONTROLLING OFFICE NAME AND ADDRESS Applied Technology Laboratory, U. S. Army Research and Technology Laboratories (AVRADCOM) Fort Eustis, Virginia 23604		11. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 1L2632ADB41
12. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 1L263-111B41		13. REPORT DATE March 1981
		14. NUMBER OF PAGES 249
		15. SECURITY CLASS. (of this report) Unclassified
		16a. DECLASSIFICATION/DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
18. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
19. SUPPLEMENTARY NOTES		
20. KEY WORDS (Continue on reverse side if necessary and identify by block number) HELICOPTERS AH-1S STRUCTURAL INTEGRITY RECORDING SYSTEM DEVELOPMENT FLIGHT CONDITION MONITORING FATIGUE DAMAGE MONITORING MECHANICAL COMPONENTS FATIGUE (MECHANICS) DATA ACQUISITION DATA PROCESSING PARAMETRIC ANALYSIS		
21. ABSTRACT (Continue on reverse side if necessary and identify by block number) A research and development program for an improved Army AH-1S helicopter Structural Integrity Recording System (SIRS) was conducted to track fatigue damage accumulation on critical helicopter components. The work was divided into five tasks. Task 1 included modification of hardware and software of five SIRS recorders fabricated under a previous contract, recording of histogram data on flight conditions representative of current missions flown by.		

DD FORM 1 JAN 75 1473

EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

342.75

1113

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

20. ABSTRACT (Continued)

AH-1S helicopters, determination of the tail rotor usage spectrum, and recording of flight parameters such as rotor RPM, engine torque, airspeed, altitude, acceleration, outside air temperature, gross weight, and pitch and roll attitude.

Task II comprised all work required for installation of the SIRS recorders in AH-1S helicopters.

Under Tasks III, IV, and V, installation of the flight recorders, monthly retrieval of data from the five aircraft, processing of data, and removal of the recorders and installation kits was performed. Recommendations for additional improvements on the recorder system and its utilization conclude this report.

1
B

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

PREFACE

Technology Incorporated, Dayton, Ohio, prepared this report to document the results of experimental R&D work for an enhanced AH-1S helicopter Structural Integrity Recording System (SIRS) program. The work was performed under contract DAAJ02-77-C-0079, which was sponsored by the Applied Technology Laboratory. The project monitor for the Army was Mr. Duane Saylor.

The principal Technology Incorporated personnel conducting this program were T. G. Farrell and J. Mecham, Program Managers; J. Dotson, Project Engineer; A. Kolb, Staff Engineer; D. Jones, Principal Software Programmer; and C. A. Shope, Data Analysis Manager. This report contains a discussion of all technical aspects of this program as well as samples of pertinent test data.

TABLE OF CONTENTS

	<u>Page</u>
PREFACE	3
LIST OF ILLUSTRATIONS	6
LIST OF TABLES	8
INTRODUCTION	9
PURPOSE	9
STRUCTURAL INTEGRITY RECORDING SYSTEM OVERVIEW	10
APPROACH	10
PROGRAM EXECUTION	11
SYSTEM DEFINITION	12
INTRODUCTION	12
FLIGHT CONDITION MONITORING METHODOLOGY	12
SIRS Onboard Recording System	13
Recorder	21
Retrieval Unit	27
STRUCTURAL INTEGRITY RECORDING SYSTEM ENHANCEMENT	32
TAKEOFF/LANDING DETECTION	32
Takeoff and Landing Logic	51
GROSS WEIGHT MEASUREMENT	67
PEAK RPM INDICATION	68
MULTIPLEXER BLEED-THROUGH	70
TORQUE MEASUREMENT SPLIT	74
RECORDER SYSTEM PERFORMANCE AND CONCLUSIONS	75
RECOMMENDATIONS	88
ABBREVIATIONS	92
APPENDIX A - SIRS RECORDER SOFTWARE	93
APPENDIX B - J-CATCH DATA	169
APPENDIX C - COMPLETE SIRS SPECTRUM USAGE DATA FOR JUNE 1980	205

LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
1	AH-1S Helicopter Instrumentation Functional Block Diagram	19
2	SIRS Recorder Functional Block Diagram . .	22
3	SIRS Retrieval Unit Functional Block Diagram	28
4	Example of SIRS Spectrum Usage Data Before Modifications	33
5	Example of Oscillograph Data Showing Two Takeoffs and Two Landings	43
6	Definition of Time Periods Considered in Study	44
7	Example of Data Extracted for Peak-to-Peak Roll Amplitudes	45
8	Frequency Polygons for Roll Angle (Degrees) 0-3 and 0-6 Seconds after Takeoff or Landing	46
9	Distribution of Peak-to-Peak Amplitude of Roll Angle (Degrees) 0-3 and 0-6 Seconds after Takeoff or Landing	47
10	Comparison of Oscilloscope and SIRS Signal Conditioning Characteristics for Roll Channel Input Above 0 Degrees	48
11	Distribution of Peak-to-Peak Amplitude of Vertical Acceleration (n_z) with Sampling Times	49
12	Torque Pressure Behavior During Takeoff and Landing	50
13	Takeoff Logic Flow Diagram	52
14	Landing Logic Flow Diagram	56

LIST OF ILLUSTRATIONS (Concluded)

<u>Figure</u>		<u>Page</u>
15	Roll Signal Characteristics on Landing . .	64
16	Original RPM Detection Circuit	68
17	Modified RPM Detection	69
18	Example of Multiplexer Cross-Talk Problem .	71
19	Example Showing "On" Impedance of New Multiplexer (4.9 Volts, Full-Scale Channel)	73
20	Example Showing "On" Impedance of New Multiplexer (0.866 Volts, Full-Scale Channel)	73
21	Example of SIRS Spectrum Usage Data After Modifications	79

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/ _____	
Availability Codes	
Dist	Avail and/or Special
A	

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Flight Condition Categories	14
2	Tri-variant Table Description	17
3	Comparison of G-model and S-model Channels	18
4	Characteristics of Transducers Containing Integral Electronics	20
5	Characteristics of Transducers with Vari- able Resistance	20
6	Remaining SIRS Channels and Corresponding Signal Characteristics	21

INTRODUCTION

The efforts reported here are part of a program to reduce cost and improve the effectiveness of U.S. Army helicopter operations. Traditional efforts to determine lifetimes of critical components use load prediction methods, flight load surveys, and laboratory fatigue tests. While this approach results in conservative service life data, in many cases components are underutilized based on the actual flight load spectrum experienced. The development of a Structural Integrity Recording System that allows recording of flight load parameters in all flight condition categories represents a major step toward full utilization of costly critical helicopter components.

PURPOSE

U.S. Army Contract DAAJ02-77-C0079, "AH-1S Helicopter Structural Integrity Recording System Program" was performed to develop the structural integrity recording system for operational use by testing five units installed on the same number of aircraft.

The recorders utilize advanced technology hardware to allow for tracking of cumulative fatigue damage on critical helicopter components such as: main rotor hub and blade assembly, main rotor control system, tail rotor, and tail rotor control system.

STRUCTURAL INTEGRITY RECORDING SYSTEM OVERVIEW

SIRS is a complete system comprising an airborne micro-processor-based recorder, a portable flight line retrieval unit, and a data processing package. The recorder monitors various flight parameters and stores preselected types of operational data within its nonvolatile solid-state memory. Data are retrieved by a portable flight line retrieval unit, which transfers the recorded data onto miniature tape cassettes. Each cassette can store the average monthly operational data of 50 helicopters. The data are processed and analyzed automatically by a software system that prints out the results in specifically formatted reports.

APPROACH

The contract performance consisted of several tasks. Task I included modification of hardware and software of five SIRS recorders fabricated under Contract DAAJ02-75-C-0050; recording of histogram data of flight conditions that are representative of current missions being flown by AH-1S helicopters; recording of tail rotor usage spectra by monitoring yaw pedal position and recording histogram data, including rudder input, airspeed, and torque; recording of maximum values of rotor RPM, engine torque, airspeed, altitude, CG acceleration, outside air temperature, gross weight, and pitch and roll attitude. Task II consisted of the fabrication of five installation kits, including transducers, mounting brackets, cables, and other hardware as required, for installation of the SIRS recorders in production AH-1S helicopters.

Under Task III a SIRS recorder was installed in an AH-1S helicopter and a two-week flight test with prescribed

flight profiles was performed. After each flight, data were retrieved to determine whether the modified SIRS recorder was detecting the prescribed flight conditions.

Task IV included the installation of the remaining four SIRS recorders on four AH-1S helicopters. Monthly retrieval of test data ensued for the remaining portion of the contract. A modified version of software developed under Contract DAAJ02-75-C-0050 was used to process the usage data.

Task V provided for the removal of the recorders and installation kits and restoration of the helicopters to their original configuration.

SYSTEM DEFINITION

INTRODUCTION

Flight condition monitoring (FCM), a method to indirectly monitor component load, can be used to assess the fatigue damage accrued in critical helicopter components. Development of an FCM system first requires definition of given flight conditions in terms of flight parameter ranges and then establishment of flight condition categories that account for the entire spectrum of fatigue-damaging flight operations. By monitoring the time spent in each flight condition category, the damage accrued by each component may be assessed on the basis of actual operation.

FLIGHT CONDITION MONITORING METHODOLOGY

The methodology for assessment of fatigue damage by monitoring flight conditions has been described in detail in Reference 1. This method of fatigue damage assessment requires use of the manufacturer's fatigue analysis for definition of a feasible flight condition monitoring system and the establishment of damage rates for each component in every flight condition category. The selected flight parameters are monitored to assess the accrued fatigue damage of critical components. The component damage accrued during a given

1. Johnson, R.B., Martin, G.L., and Moran, M.S., A FEASIBILITY STUDY FOR MONITORING SYSTEMS OF FATIGUE DAMAGE TO HELICOPTER COMPONENTS, Technology Incorporated; USAAMRDL Technical Report 74-92, Eustis Directorate, U.S. Army Air Mobility Research and Development Laboratory, Fort Eustis, Virginia, January 1975, AD A006641.

recording period is computed by adding the incremental damage from each flight condition category in order to obtain the total component damage. The flight condition categories for the AH-1S helicopter are shown in Tables 1 and 2.

SIRS Onboard Recording System

The onboard recording portion of the SIRS consists of an all-solid-state recorder and a complement of transducers installed for monitoring and real-time processing of the basic aircraft parameters (BAP). In adapting the system to the AH-1S Cobra from the original AH-1G Cobra configuration, only three instrumentation channels were affected. Those channels were the "aircraft pitch angle channel", which was eliminated in favor of a "rudder position channel", and the "torque signal" and "torque reference" channels, which had to be modified to accept low-level signals from a DC-excited strain gauge torque transmitter. The new torque signals were derived by tapping into the existing pilot's torque transmitter, but the new rudder position channel required installation of a 10-K Ω rotary potentiometer with associated linkage and mounting brackets. Table 3 shows a comparison of the original G-model channels and the new S-model channels. Figure 1 is a functional block diagram of the S-model instrumentation, specifying part numbers of transducers added as part of the installation kit.

TABLE 1. FLIGHT CONDITION CATEGORIES

<u>FCC NO.*</u>	<u>FCC DESCRIPTION</u>	<u>SECONDS PER COUNT</u>	<u>OCCURRENCE</u>
1,2,3	Gunnery Turn A/S <0.5 VH	0.1	
4,5,6	Gunnery Turn A/S 0.5-0.7 VH	0.1	
7,8,9	Gunnery Turn A/S 0.7-0.9 VH	0.1	
10,11,12	Gunnery Turn A/S >0.9 VH	0.1	
13,14,15	Gun S-Turn A/S <0.5 VH	0.1	
16,17,18	Gun S-Turn A/S 0.5-0.7 VH	0.1	
19,20,21	Gun S-Turn A/S 0.7-0.9 VH	0.1	
22,23,24	Gun S-Turn A/S >0.9 VH	0.1	
25,26,27	Hover A/S <0.3 VH	3.2	
28,29,30	Cruise A/S 0.3-0.5 VH	3.2	
31,32,33	Cruise A/S 0.5-0.6 VH	3.2	
34,35,36	Cruise A/S 0.6-0.7 VH	3.2	
37,38,39	Cruise A/S 0.7-0.8 VH	3.2	
40,41,42	Cruise A/S 0.8-0.9 VH	3.2	
43,44,45	Cruise A/S 0.9-1.0 VH	3.2	
46,47,48	Cruise A/S 1.0-1.1 VH	3.2	
49,50,51	Cruise A/S >1.1 VH	3.2	
52,53,54	Climb A/S >0.5 VH	3.2	
55,56,57	Descent A/S >0.5 VH	3.2	
58,59,60	Acceleration to Climb	3.2	
61,62,63	Flare	N/A	OCC
64,65,66	N _z Peaks 1.1-1.3 G	N/A	OCC
67,68,69	N _z Peaks 1.3-1.5 G	N/A	OCC
70,71,72	N _z Peaks 1.5-1.7 G	N/A	OCC
73,74,75	N _z Peaks >1.7 G	N/A	OCC
76-243	Tri-Variant Table (for description, see Table 2)	1.0	
244	Rotor Cycles		OCC
245	Normal Landings		OCC
246	Autorotative Landings		OCC
247	RPM Peak Value		
248	Torque Peak Value		
249	VL Peak Value		
250	VH Peak Value		
251	Density Altitude Peak		
252	Vertical Acceleration Peak		
253	OAT Maximum Value		
254	OAT Minimum Value		
255	Gross Weight Peak Value		
256	Roll Peak		

* Note: Three flight condition category numbers on the same line indicate that the maneuver is recorded as a function of three gross weight ranges.

TABLE 1. (Continued)

<u>FCC NO.</u>	<u>FCC DESCRIPTION</u>	<u>SECONDS PER COUNT</u>	<u>OCCURRENCE</u>
257	Unused Memory Locations		
258			
259			
260			
261			
262			
263			
264			
265			
266			
267,268,269	Gross Weight Histogram	0.1	
270	Ground Time	0.1	
271,272,273	Normal Turns A/S <0.5 VH	0.1	
274,275,276	Normal Turns A/S 0.5-0.7 VH	0.1	
277,278,279	Normal Turns A/S 0.7-0.9 VH	0.1	
280,281,282	Normal Turns A/S >0.9 VH	0.1	
283,284,285	Autorotative Turns $N_z < 1.5$ G	0.1	
286,287,288	Autorotative Turns $N_z > 1.5$ G	0.1	
289,290,291	Autorotative Time	0.1	
292,293,294	Symmetrical Dive	0.1	
295,296,297	Assymmetrical Dive	0.1	
298,299,300	Symmetrical Pullup	0.1	
301,302,303	Assymmetrical Pullup	0.1	
304	Density Alt Histogram <1K	0.1	
305	Density Alt Histogram 1-2K	0.1	
306	Density Alt Histogram 2-3K	0.1	
307	Density Alt Histogram 3-4K	0.1	
308	Density Alt Histogram 4-5K	0.1	
309	Density Alt Histogram 5-6K	0.1	
310	Density Alt Histogram 6-7K	0.1	
311	Density Alt Histogram 7-8K	0.1	
312	Density Alt Histogram 8-9K	0.1	
313	Density Alt Histogram 9-10K	0.1	
314	Density Alt Histogram 0.10K	0.1	
315	RPM Histogram <314	0.1	
316	RPM Histogram 314-319	0.1	
317	RPM Histogram 319-324	0.1	
318	RPM Histogram 324-329	0.1	
319	RPM Histogram 329-334	0.1	
320	RPM Histogram 334-339	0.1	
321	RPM Histogram >339	0.1	
322	Torque Histogram <10 PSI	0.1	
323	Torque Histogram 10-20 PSI	0.1	
324	Torque Histogram 20-30 PSI	0.1	
325	Torque Histogram 30-40 PSI	0.1	
326	Torque Histogram 40-50 PSI	0.1	
327	Torque Histogram >50 PSI	0.1	

TABLE 1. (Concluded)

<u>FCC NO.</u>	<u>FCC DESCRIPTION</u>	<u>SECONDS PER COUNT</u>	<u>OCCURRENCE</u>
528	N ₂ Intercept		
529	N ₂ Slope		
530	Altitude Intercept		
531	Altitude Slope		
532	A/S Intercept		
533	A/S Slope		
534	Gross Weight Intercept		
535	Gross Weight Slope		
536	Torque Intercept		
537	Torque Slope		
538	Rudder Intercept		
539	Rudder Slope		

TABLE 2. TRI-VARIANT TABLE DESCRIPTION
(Values in Parentheses Recorded in Seconds)

<u>FCC NO.</u>	<u>RUDDER (%)</u>	<u>A/S (VH)</u>	<u>TORQUE (PSI)</u>
76	0-10	<0.5	<10
77	0-10	<0.5	10-20
78	0-10	<0.5	20-30
79	0-10	<0.5	30-40
80	0-10	<0.5	40-50
81	0-10	<0.5	>50
82-87	0-10	0.5-0.7	(6)
88-93	0-10	0.7-0.9	(6)
94-99	0-10	>0.9	(6)
100-123	10-20	(4)	(6)
124-147	20-40	(4)	(6)
148-171	40-60	(4)	(6)
172-195	60-80	(4)	(6)
196-219	80-90	(4)	(6)
220-243	>90	(4)	(6)

TABLE 3. COMPARISON OF G-MODEL AND S-MODEL CHANNELS

CHNL NO.	G-MODEL		S-MODEL	
	Added Xducer	Acft Xducer	Added Xducer	Acft Xducer
1	Rotor Speed	X	Rotor Speed	X
2	Roll Angle	X	Roll Angle	X
3	Roll Reference	X	Roll Reference	X
4	Pitch Angle	X	Rudder Position	X
5	Torque	X	Torque	X
6	Torque Reference	X	Torque Reference	X
7	Vert Acceleration	X	Vert Acceleration	X
8	Press Altitude	X	Press Altitude	X
9	Airspeed	X	Airspeed	X
10	Outside Air Temp	X	Outside Air Temp	X
11	Gross Weight	X	Gross Weight	X

The types of dedicated transducers added as part of the SIRS recording system can be divided into two categories. One category is transducers containing integral electronics that provide a high-level DC output representative of the parameter being monitored. The characteristics of these transducers are as shown in Table 4.

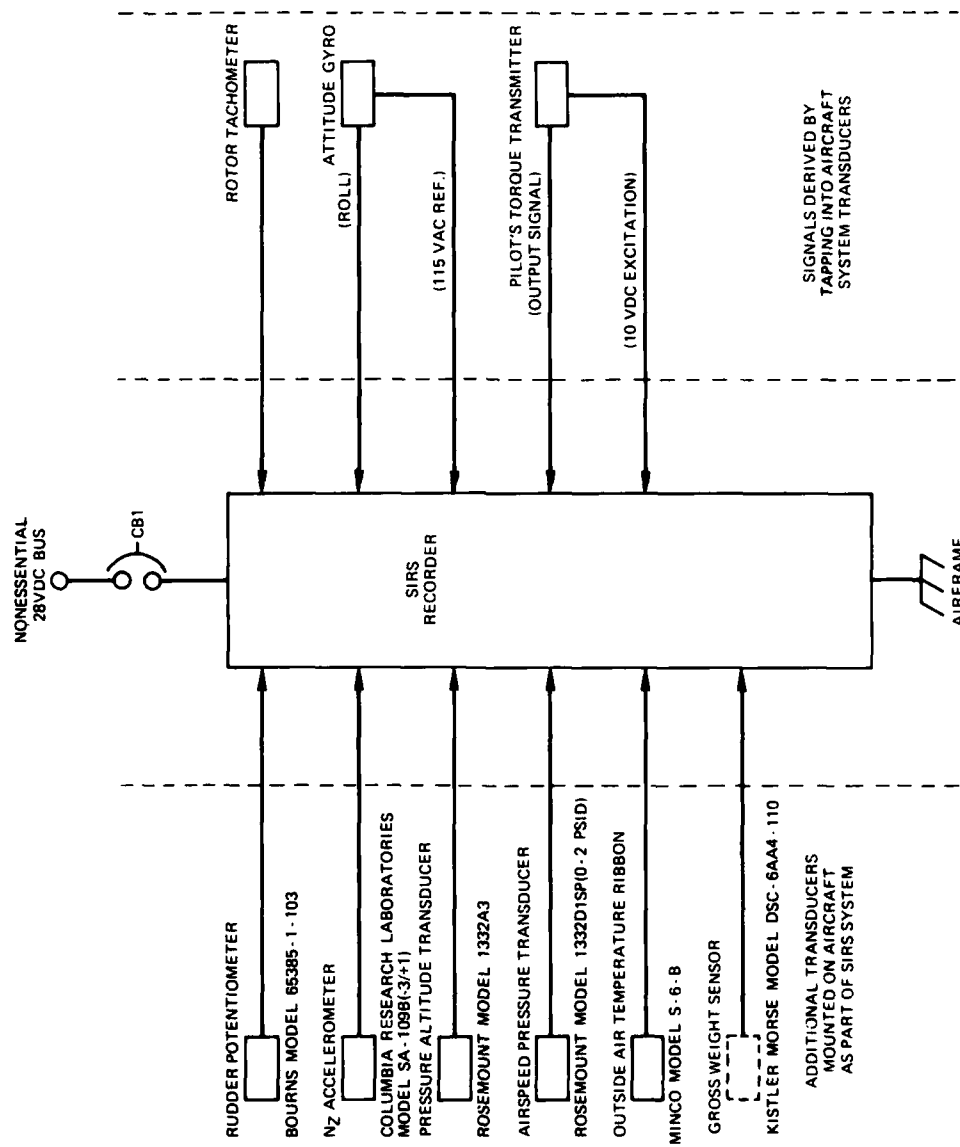


Figure 1. AH-1S Helicopter Instrumentation Functional Block Diagram.

TABLE 4. CHARACTERISTICS OF TRANSDUCERS
CONTAINING INTEGRAL ELECTRONICS

<u>Ch. No.</u>	<u>Parameter</u>	<u>Transducer Type</u>	<u>Range</u>	<u>Excitation</u>	<u>Output</u>
7	Vertical Acceler- ation	Force Bal. Acceler- ometer	$\pm 2g$	28 VDC	0-5 VDC
8	Pressure Altitude	Capacitive Pressure Transducer	0-15 PSIA	28 VDC	0-5 VDC
9	Airspeed	Capacitive Pressure Transducer	0-2 PSID	28 VDC	0-5 VDC

The other category is devices that vary in resistance proportionally with input parameter. They require more extensive signal conditioning within the SIRS recorder in that they are set up as active arms of a four-arm bridge network or as active portions of a voltage divider. The characteristics of these transducers are shown in Table 5.

TABLE 5. CHARACTERISTICS OF TRANSDUCERS
WITH VARIABLE RESISTANCE

<u>Ch. No.</u>	<u>Parameter</u>	<u>Transducer Type</u>	<u>Specifications</u>
4	Rudder Position	Potentiometer	10K Ω Rotary
10	Outside Air Temperature	Nickel-Iron Temperature Ribbon	676 Ω @25°C, -62°C to 230°C Range
11	Gross Weight	Piezoresistive Beam	2 active 1K Ω arms, 0-0.015 in. defl.

The remaining channels derive their inputs from the aircraft's instrumentation. For this prototype effort, in-line butt splices were used to make parallel connections between the aircraft indicators and the SIRS recorder input channels. The channels and the corresponding signal characteristics are as shown in Table 6.

TABLE 6. REMAINING SIRS CHANNELS AND CORRESPONDING SIGNAL CHARACTERISTICS

<u>Ch. No.</u>	<u>Parameter</u>	<u>Transmitter</u>	<u>Signal</u>
1	Rotor Speed	Tachometer Generator	0-80 Hz Sine Wave
2	Roll Angle	Attitude Gyro	Roll Synchro, Sine θ , 0-12 VAC RMS @ 400 Hz
3	Roll Reference	Attitude Gyro	115 VAC RMS @ 400 Hz
5	Torque	Pilot's Torque Transmitter	0-100 m VDC
6	Torque Reference	Pilot's Torque Transmitter	10 VDC Nominal

Recorder

The SIRS recorder is a Motorola 6800 microprocessor-based device utilizing CMOS (complementary metal oxide silicon) logic memory with battery backup to implement a nonvolatile data storage area. Figure 2 is a detailed functional block diagram of the recorder. The functions can be divided into four major groups: signal conditioning, processing, data storage, and serial communications.

The signal conditioning portion of the recorder accepts the transducer inputs and converts all signals to DC

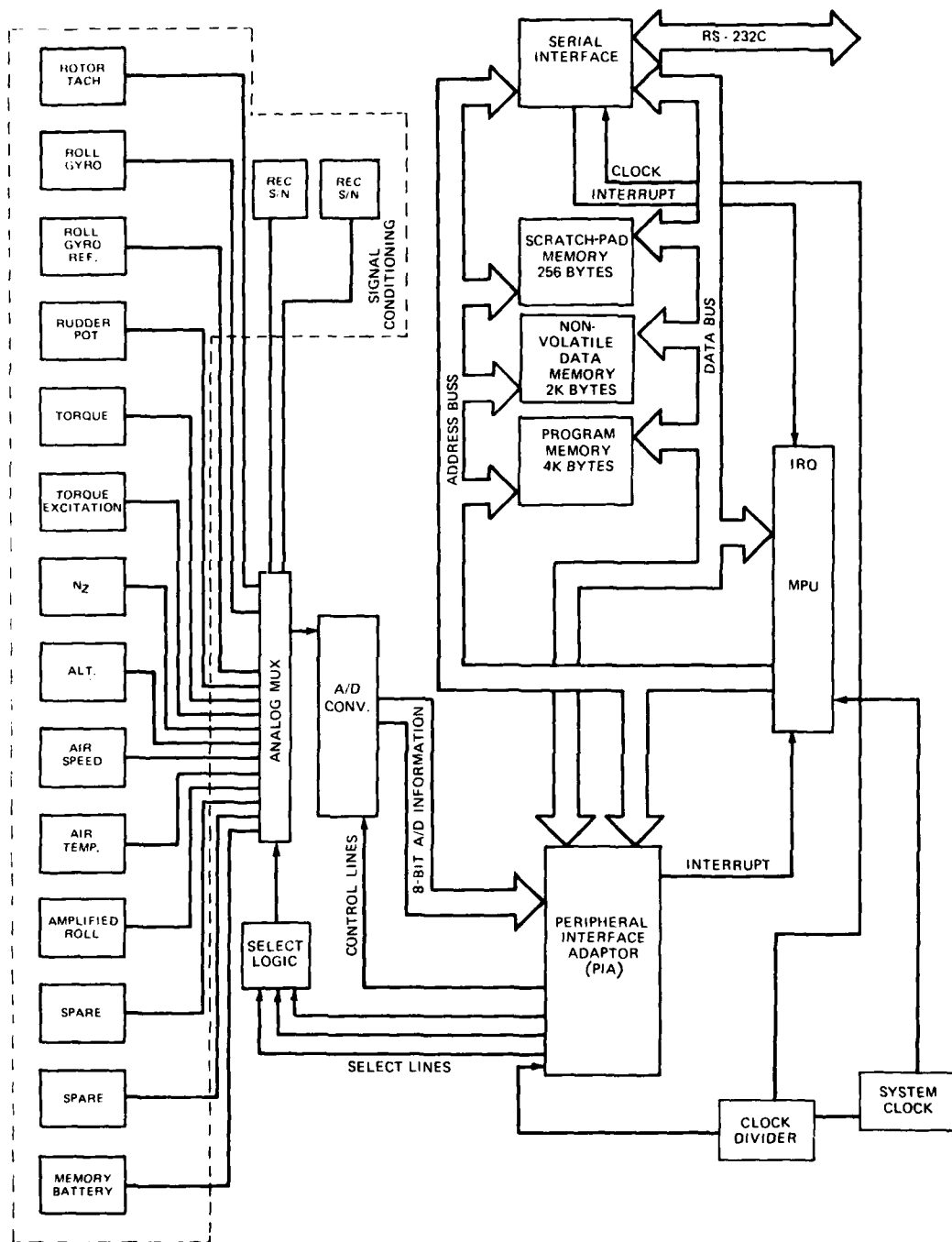


Figure 2. SIRS Recorder Functional Block Diagram.

levels in the 0-5 VDC range. Most channels have their own unique front end amplifier and in the case of the 400-Hz channels (roll and roll reference), a rectifier and filter section. For transducers that have internal electronics and already present high-level DC signals to the recorder (altitude, airspeed, and vertical acceleration), only low-pass filter stages are provided. The signal conditioning of the rotor RPM channel is unique in that the frequency of the signal rather than the amplitude is the primary variable that is monitored. Correspondingly, the recorder incorporates a frequency-to-DC converter section for this channel.

In addition to conditioning the eleven external signals, three internal parameters are conditioned and monitored. They are the recorder serial number high-order byte, the recorder serial number low-order byte, and the nonvolatile data memory battery voltage. The recorder serial number is read by the processing section and transmitted to the SIRS retrieval unit automatically during a normal data retrieval. This information is stored as header information on the magnetic tape and can later be used as a cross check to verify the accuracy of the aircraft tail number as entered manually by the retrieval unit operator at the time of data collection. The recorder serial number can be manually programmed by means of 16 jumpers arranged on the signal conditioning board in a binary digital format. Resistive ladder-type digital-to-analog converter stages for each 8-bit byte of the serial number present DC levels to the input multiplexer stage. These DC levels may then be converted and processed in the same manner as all of the other input channels. The nonvolatile data memory battery voltage is also routed to the

input multiplexer stage. The voltage level is processed and transmitted to the retrieval unit at the time of data transfer. If the voltage level falls below a preset threshold, the retrieval unit flashes the message "Battery" at the time of retrieval, thus warning the operator to replace the recorder batteries.

Sixteen DC levels (eleven input channels, two serial number channels, one recorder battery channel, and two spare input channels) are routed to the input multiplexer stage. Here, under program control, each channel is individually selected and routed to an 8-bit analog-to-digital converter. The results of each A/D conversion are then stored in the recorder's scratch-pad memory where they can be further processed by the recorder data reduction algorithms resident in the recorder program memory.

The processing portion of the SIRS recorder is made up of the basic functional elements required of a microcomputer: processor, program memory, scratch-pad memory, and input/output devices. The processor is a Motorola 6800 device with a 16-bit address bus, an 8-bit data bus, and various control lines necessary to integrate the memory and input/output devices into a functioning system. Program memory consists of 4096 8-bit bytes of non-volatile read-only memory. This memory is implemented by using two 1024 x 8-bit and one 2048 x 8-bit erasable programmable read-only memory (EPROM) chips. All of the algorithms necessary to define and recognize the selected flight condition categories in terms of levels and sequences of the basic aircraft parameters are contained in this memory. In addition, power-up-restart and interrupt service routines contained in this memory area serve to make

the onboard recording system a completely hands-off system capable of initiating the recording process with the application of aircraft power. A complete listing of the program data contained in this memory is included as Appendix A.

Scratch-pad memory is 256 8-bit bytes of read/write memory implemented with two 128 x 8-bit random access memory (RAM) devices. This memory space is used to keep a continuously updated tabulation of flags signifying a level quantization of each input variable. Also, results of calculations concerning the linearization of airspeed and altitude inputs, results of limit velocity calculations, and immediate past history tables of torque are kept in this memory area.

The input/output devices in the recorder are an asynchronous serial communications interface used strictly for transferring data to and from the companion retrieval unit and a parallel interface port used to accept parallel 8-bit digital data from the analog-to-digital converter and to transmit control codes to the converter and to the 16-channel analog input multiplexer. These devices are attached to the processor address and data buses; the data buffers inside the devices can be accessed by the processor.

The data storage medium of the recorder is a designated portion of read/write memory implemented with low-power complementary metal oxide silicon (CMOS) logic memory chips. This memory area is made nonvolatile by taking advantage of the CMOS logic family's ability to maintain the data stored in each bit cell during standby operation (no data being

written into or read from memory) with minimal power applied to the power input pins of each chip. This data storage capability is implemented by connecting two 3-volt lithium batteries in parallel and then, using diode isolation, connecting this power source to the memory chips. During normal operation, the memory is powered by the recorder +5 VDC supply and the batteries are effectively out of the circuit. When power is removed from the recorder, current is drawn from the batteries and the data is maintained in the memory.

In adapting the SIRS recorder to the AH-1S Cobra, more flight condition categories and histogram data areas were added. This necessitated the addition of more data storage area and program memory. As a result the design of an "extended memory" printed circuit board that could be interfaced to the recorder's address and data buses was completed. This new board contains the 2048 x 8-bit EPROM described above and sockets for a 2048 x 8-bit data storage area. As manufactured, only 1024 x 8 bits of data storage was installed; thus the new board allows for a 100 percent expansion in memory space.

The final major function implemented within the recorder is serial communications with the companion SIRS data retrieval unit. The primary task of this function is to transfer the data contained in the nonvolatile storage area of the recorder to the retrieval unit so that it may be written onto magnetic tape. However, certain other important features rely on this communications channel. The recorder has the capability of transmitting the real-time analog-to-digital conversion results of any one of the input channels for display on the retrieval unit front panel.

This feature allows the operator to verify the functioning of the recording system, troubleshoot any of the instrumentation channels, and calibrate the system. Calibration of certain channels can be accomplished by entering slopes and intercepts to be stored in the nonvolatile data storage area. These constants are also entered from the retrieval unit via the communications channel.

The hardware used to implement the serial communications channel within the recorder consists of an asynchronous communications interface adapter (ACIA) and logic level shifting chips to convert transistor-transistor logic (TTL) logic levels to EIA RS232C standard logic levels. The send and receive portions of the channel are programmed to transfer data at a 300-baud rate.

Retrieval Unit

The SIRS retrieval unit is also a Motorola 6800 microprocessor-based device. The prime function of the retrieval unit is to transfer the data stored in the recorder's nonvolatile storage area to magnetic tape on-site and then play the data back from the tape to a printing device or into a computer for further processing. The unit is a portable, battery-operated device capable of powering the SIRS recorder during the data retrieval function. In this way no power is drawn from the aircraft battery and communications with the recorder can be accomplished outside of the original aircraft installation. Figure 3 is a detailed functional block diagram of the retrieval unit. The functions can be divided into five major groups: processing, serial communications, front panel message display, tape cassette control, and keypad interface.

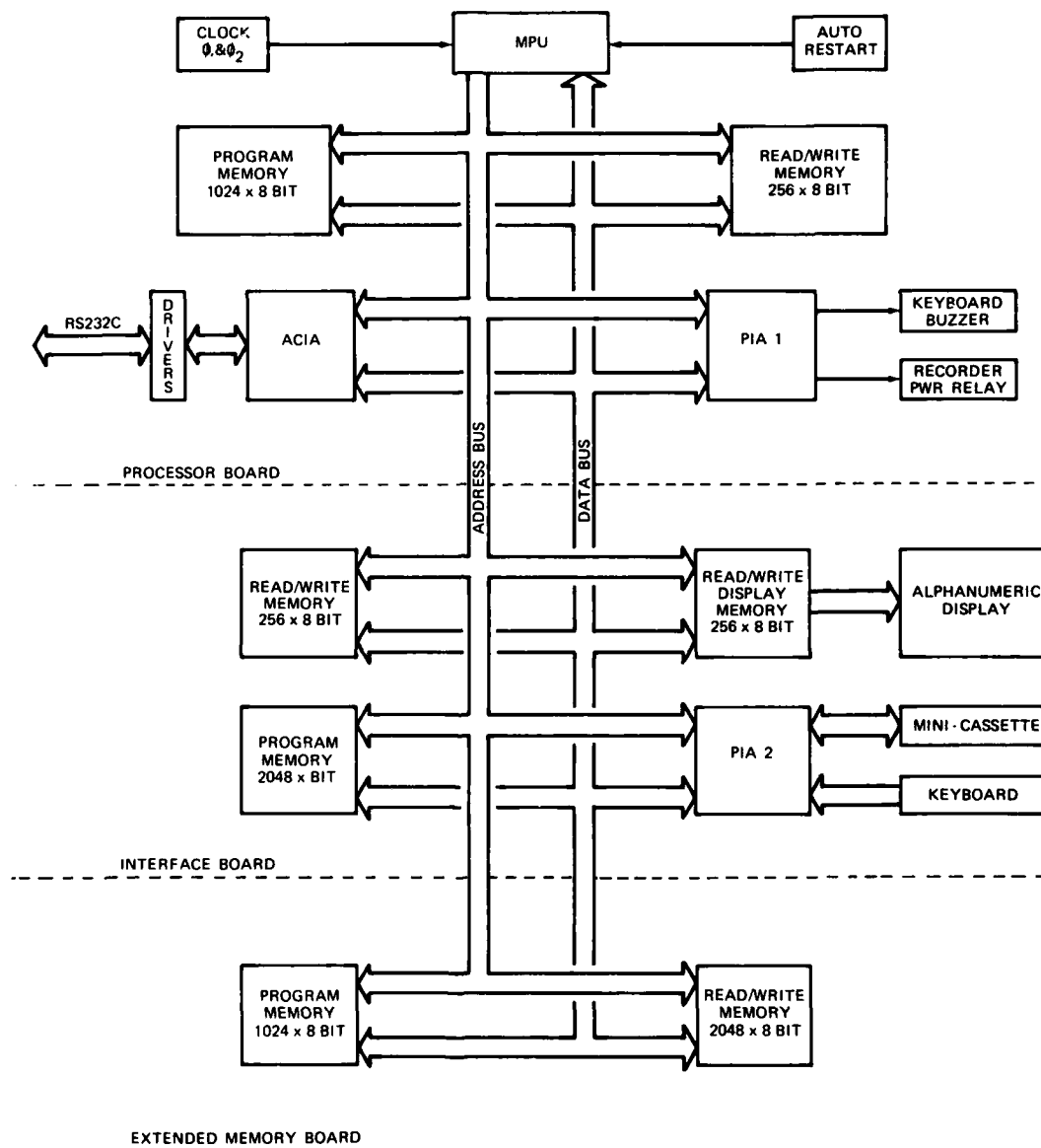


Figure 3. SIRS Retrieval Unit Functional Block Diagram.

The processing portion of the retrieval unit, as in the recorder, consists of the basic microcomputer functional elements: processor, program memory, scratch-pad memory, and input/output devices. The processor is a Motorola 6800 device with a 16-bit address bus, an 8-bit data bus, and various control lines necessary to integrate the memory and input/output devices into a functioning system. Program memory in the retrieval unit has been increased from the original 4096 8-bit bytes of the model used on the AH-1G program to the current 5120 8-bit bytes of nonvolatile, read-only memory. This memory is implemented by using five 1024 x 8-bit EPROM devices. All of the algorithms necessary to establish communications with the recorder, actively interface with the operator via the front panel display and keypad, and control the transfer of data to and from the built-in magnetic tape cassette drive are contained in this memory.

4
F

Scratch-pad memory consists of 1536 8-bit bytes of read/write memory implemented with four 128 x 8-bit and eight 1024 x 1-bit RAM devices. This memory space is used as a working area to temporarily store status and data values encountered while interfacing with the various input/output functions and also as a temporary intermediate data storage area for the recorder data. Data from the recorder are transferred into this memory area while power is being supplied to the recorder from the retrieval unit. Then, after power has been removed from the recorder, the data in this memory area are transferred onto the miniature tape cassette. Although only 1536 bytes of RAM are installed, slots exist for an additional 1000 bytes of RAM on the extended memory printed circuit board located in the unit.

The input/output devices in the retrieval unit consist of an asynchronous serial communications device, two parallel interface devices, and a custom alphanumeric display driver channel. The serial communications channel consists of transmit and receive lines used to transfer data to and from the recorder and to output data to a printing device or a computer port. One of the parallel input/output devices is used to interface with both the mini-cassette tape drive and the front panel-mounted keypad used for operator command entries. The other parallel input/output device is used only to implement a keypad feedback feature (an audible tone when any key is pressed) and to control the application of power to the SIRS recorder when communication between the two units is required. As an interface to the processor the alphanumeric display channel functionally represents a 128 x 8-bit RAM area. Data to be presented on the front panel display are written into the appropriate memory locations and no other action is required of the processor until new data are to be displayed. The display channel is actually configured as a two-port memory in that once the processor writes data into this area, it is read from the memory under hardware control (independent of the processor) and routed to the alphanumeric display via a display character generator. This hardware configuration allows the display to be refreshed and to be flashed on and off, thus saving battery power, without adding any overhead to the retrieval unit program.

The hardware used to implement the serial communications function consists of an ACIA input/output port as described above and logic level shifting integrated circuits to convert

TTL logic levels to EIA RS232C standard logic levels. Both the send and receive portions of the channel are programmed to match the recorder's 300-baud data transfer rate.

The front panel alphanumeric display function and the front panel keypad interface function allow for retrieval unit and operator interaction. The display area consists of 16 characters, eight of which are reserved for messages generated by the retrieval unit to query the operator as to what function he wishes to perform or to notify the operator that a function has been completed or that an error has occurred. The other eight characters are used to echo the operator's keypad-entered command codes and to display any data that may be obtained as a result of completing one of the instructed functions.

The tape cassette control function is implemented by using a parallel input/output port to drive a separate tape cassette controller assembly. Data to be written onto or read from the tape cassette as well as all of the control lines necessary to implement the read, write, rewind, erase, search forward, and search backward functions pass through this parallel port. This new model retrieval unit has incorporated a bidirectional tape drive to replace the unidirectional drive used for the AH-1G program. The controlled rewind speed of the drive has greatly enhanced the data search and verify functions and thus increased system reliability.

STRUCTURAL INTEGRITY RECORDING SYSTEM ENHANCEMENT

During the initial operational phase of the recording system, several areas indicated the need for improvements or modifications in order to achieve proper retrieval and storage of test data. Some of the improvements were related to signal detection and processing techniques while others are related to components of the recorder system. Following is a detailed description of modifications and improvements investigated.

TAKEOFF/LANDING DETECTION

Comparison of data retrievals from the SIRS recorder with logbook flight times frequently indicated numerous discrepancies during the data collection time span from February 1979 to January 1980. The symptoms apparent in the data were an excessive amount of recorded ground time and minimal amounts of recorded flight time. The problem was determined to be ineffective takeoff and landing detection.

A drastic example of this problem is illustrated in the data printout shown in Figure 4. During the data collection period ending 8 January 1980 the logbook time accrued on Aircraft 76-22574 was 37.5 hours. As can be seen, the recorder indicated 31.9 hours of ground time and 0.0 hours of flight time. In this case the liftlink mounted gross weight sensor signal, which was also used to sense "in-the-air" and "on-the-ground" conditions, did not indicate that a takeoff had ever occurred. The result was that only those flight condition categories that are updated when the aircraft is "on-the-ground" were recorded. Those categories were Rotor Cycles, Ground Time, and Peak Values.

SIRS SPECTRUM USAGE

PAGE 1

AIRCRAFT: 76-22574. LOG TIME: 887.6 RETRIEVAL DATE: 01/1/80 REASON: COMPONENT REPLACEMENT
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 37.5 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
GUN TURN <.5 VH	TOTAL	0.0	0.0
1	<7750	0.0	0.0
2	7750-8750	0.0	0.0
3	>8750	0.0	0.0
GUN TURN .5-.7 VH	TOTAL	0.0	0.0
4	<7750	0.0	0.0
5	7750-8750	0.0	0.0
6	>8750	0.0	0.0
GUN TURN .7-.9 VH	TOTAL	0.0	0.0
7	<7750	0.0	0.0
8	7750-8750	0.0	0.0
9	>8750	0.0	0.0
GUN TURN >.9 VH	TOTAL	0.0	0.0
10	<7750	0.0	0.0
11	7750-8750	0.0	0.0
12	>8750	0.0	0.0
GUN S TURN <.5 VH	TOTAL	0.0	0.0
13	<7750	0.0	0.0
14	7750-8750	0.0	0.0
15	>8750	0.0	0.0
GUN S TURN .5-.7 VH	TOTAL	0.0	0.0
16	<7750	0.0	0.0
17	7750-8750	0.0	0.0
18	>8750	0.0	0.0
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0
19	<7750	0.0	0.0
20	7750-8750	0.0	0.0
21	>8750	0.0	0.0
GUN S TURN >.9 VH	TOTAL	0.0	0.0
22	<7750	0.0	0.0
23	7750-8750	0.0	0.0
24	>8750	0.0	0.0
HOVER <.3 VH	TOTAL	0.0	0.0
25	<7750	0.0	0.0
26	7750-8750	0.0	0.0
27	>8750	0.0	0.0
CRUISE .3-.5 VH	TOTAL	0.0	0.0
28	<7750	0.0	0.0
29	7750-8750	0.0	0.0
30	>8750	0.0	0.0

Figure 4. Example of SIRS Spectrum Usage Data Before Modifications.

SIRS SPECTRUM USAGE

PAGE 2

AIRCRAFT: 76-22574. LOG TIME: 887.6 RETRIEVAL DATE: 8/ 1/80 REASON: COMPONENT REPLACEMENT
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 37.5 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE

FLIGHT CONDITION	GROSS WEIGHT (LB.)	TIME (HOURS)		OCCURRENCE	
		RETRIEVAL	PER 100 HOURS	RETRIEVAL	PER 100 HOURS
CRUISE .5-.6 VH	TOTAL	0.0	0.0		
31	<7750	0.0	0.0		
32	7750-8750	0.0	0.0		
33	>8750	0.0	0.0		
CRUISE .6-.7 VH	TOTAL	0.0	0.0		
34	<7750	0.0	0.0		
35	7750-8750	0.0	0.0		
36	>8750	0.0	0.0		
CRUISE .7-.8 VH	TOTAL	0.0	0.0		
37	<7750	0.0	0.0		
38	7750-8750	0.0	0.0		
39	>8750	0.0	0.0		
CRUISE .8-.9 VH	TOTAL	0.0	0.0		
40	<7750	0.0	0.0		
41	7750-8750	0.0	0.0		
42	>8750	0.0	0.0		
CRUISE .9-1.0 VH	TOTAL	0.0	0.0		
43	<7750	0.0	0.0		
44	7750-8750	0.0	0.0		
45	>8750	0.0	0.0		
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0		
46	<7750	0.0	0.0		
47	7750-8750	0.0	0.0		
48	>8750	0.0	0.0		
CRUISE >1.1 VH	TOTAL	0.0	0.0		
49	<7750	0.0	0.0		
50	7750-8750	0.0	0.0		
51	>8750	0.0	0.0		
CLIMB >.5 VH	TOTAL	0.0	0.0		
52	<7750	0.0	0.0		
53	7750-8750	0.0	0.0		
54	>8750	0.0	0.0		
DESCENT >.5 VF	TOTAL	0.0	0.0		
55	<7750	0.0	0.0		
56	7750-8750	0.0	0.0		
57	>8750	0.0	0.0		
ACCEL TO CLIMB	TOTAL	0.0	0.0		
58	<7750	0.0	0.0		
59	7750-8750	0.0	0.0		
60	>8750	0.0	0.0		

Figure 4. (Continued)

AIRCRAFT: 76-22574. LOG TIME: 887.6 RETRIEVAL DATE: 8/ 1/80 REASON: COMPONENT REPLACEMENT
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 37.5 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE	
		RETRIEVAL	PER 100 HOURS	RETRIEVAL	PER 100 HOURS
FLARE	TOTAL			0.	0.
61	<7750			0.	0.
62	7750-8750			0.	0.
63	>8750			0.	0.
NZ PEAKS 1.1-1.3 G	TOTAL			0.	0.
64	<7750			0.	0.
65	7750-8750			0.	0.
66	>8750			0.	0.
NZ PEAKS 1.3-1.5 G	TOTAL			0.	0.
67	<7750			0.	0.
68	7750-8750			0.	0.
69	>8750			0.	0.
NZ PEAKS 1.5-1.7 G	TOTAL			0.	0.
70	<7750			0.	0.
71	7750-8750			0.	0.
72	>8750			0.	0.
NZ PEAKS >1.7 G	TOTAL			0.	0.
73	<7750			0.	0.
74	7750-8750			0.	0.
75	>8750			0.	0.
ROTOR CYCLES	TOTAL			161.	0.
244				161.	0.
NORMAL LANDINGS	TOTAL			0.	0.
245				0.	0.
AUTOROTATIVE LNDGS	TOTAL			0.	0.
246				0.	0.
FLIGHT TIME	TOTAL	0.0	0.0		
267	<7750	0.0	0.0		
268	7750-8750	0.0	0.0		
269	>8750	0.0	0.0		
GROUND TIME	TOTAL	31.9	0.0		
270		31.9	0.0		
NORMAL TURN <.5 VR	TOTAL	0.0	0.0		
271	<7750	0.0	0.0		
272	7750-8750	0.0	0.0		
273	>8750	0.0	0.0		
NORMAL TURN .5-.7 VR	TOTAL	0.0	0.0		
274	<7750	0.0	0.0		
275	7750-8750	0.0	0.0		
276	>8750	0.0	0.0		

Figure 4. (Continued)

SIRS SPECTRUM USAGE

PAGE 4

AIRCRAFT: 76-22574. LOG TIME: 887.6 RETRIEVAL DATE: 8/ 1/80 REASON: COMPONENT REPLACEMENT
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 37.5 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE	
		RETRIEVAL	PER 100 HOURS	RETRIEVAL	PER 100 HOURS
NORMAL TURN .7-.9 VH	TOTAL	0.0	0.0		
277	<7750	0.0	0.0		
278	7750-8750	0.0	0.0		
279	>8750	0.0	0.0		
NORMAL TURN >.9 VH	TOTAL	0.0	0.0		
280	<7750	0.0	0.0		
281	7750-8750	0.0	0.0		
282	>8750	0.0	0.0		
AUTO TURNS NZ<1.5 G	TOTAL	0.0	0.0		
283	<7750	0.0	0.0		
284	7750-8750	0.0	0.0		
285	>8750	0.0	0.0		
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0		
286	<7750	0.0	0.0		
287	7750-8750	0.0	0.0		
288	>8750	0.0	0.0		
AUTOROTATIVE TIME	TOTAL	0.0	0.0		
289	<7750	0.0	0.0		
290	7750-8750	0.0	0.0		
291	>8750	0.0	0.0		
SYMMETRICAL DIVE	TOTAL	0.0	0.0		
292	<7750	0.0	0.0		
293	7750-8750	0.0	0.0		
294	>8750	0.0	0.0		
ASYMMETRICAL DIVE	TOTAL	0.0	0.0		
295	<7750	0.0	0.0		
296	7750-8750	0.0	0.0		
297	>8750	0.0	0.0		
SYMMETRICAL PULLUP	TOTAL	0.0	0.0		
298	<7750	0.0	0.0		
299	7750-8750	0.0	0.0		
300	>8750	0.0	0.0		
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0		
301	<7750	0.0	0.0		
302	7750-8750	0.0	0.0		
303	>8750	0.0	0.0		

Figure 4. (Continued)

SIRS SPECTRUM USAGE

PAGE 5

AIRCRAFT: 76-22574. LOG TIME: 887.6 RETRIEVAL DATE: 8/ 1/80 REASON: COMPONENT REPLACEMENT
 RECORDER: 1305 BASE: 1
 DELTA LOG TIME: 37.5 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247	RPM PEAK VALUE	360.8
248	TORQUE PEAK VALUE	64.5
249	VL PEAK VALUE	0.6
250	VH PEAK VALUE	0.8
251	DENS ALT PEAK VALUE	5331.2
252	NZ PEAK VALUE	1.8
253	OAT MAXIMUM VALUE	24.5
254	OAT MINIMUM VALUE	2.0
255	GROSS WEIGHT PEAK	10600.0
256	ROLL PEAK VALUE	62.0

	DENSITY ALTITUDE HISTOGRAM											
	ALTITUDE (K FT)											
	<1	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FLT COND NRS	304	305	306	307	308	309	310	311	312	313	314	0.0

	RPM HISTOGRAM								
	RPM								
	<314	314	319	324	329	334	339	TOTAL	
RETRIEVAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
FLT COND NRS	315	316	317	318	319	320	321	0.0	

	TORQUE HISTOGRAM						
	TORQUE (PSI)						
	<10	10	20	30	40	50	TOTAL
RETRIEVAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FLT COND NRS	322	323	324	325	326	327	0.0

Figure 4. (Continued)

SIRS SPECTRUM USAGE

PAGE 5

AIRCRAFT: 76-22074, LOG TIME: 887.6 RETRIEVAL DATE: 8/ 1/80 REASON: COMPONENT REPLACEMENT
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 37.5 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: <10°

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5								76- 81
PER 100 HRS								
.5								82- 87
PER 100 HRS								
.7								88- 93
PER 100 HRS								
.9								94- 98
PER 100 HRS								
***TOTAL								
PER 100 HRS								

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 10-20°

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5								100-105
PER 100 HRS								
.5								106-111
PER 100 HRS								
.7								112-117
PER 100 HRS								
.9								118-123
PER 100 HRS								
***TOTAL								
PER 100 HRS								

Figure 4. (Continued)

CIRS SPECTRUM USAGE

PAGE 7

AIRCRAFT: 76-22574. LOG TIME: 8d7.6 RETRIEVAL DATE: 8/ 1/80 REASON: COMPONENT REPLACEMENT
 RECORDNR: 1005 BASE: 1
 DELTA LOG TIME: 37.1 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 20-40%

A/S (VH)	<10	10	TORQUE (PSI) 20	30	40	50	TOTAL	FLIGHT CONDITION
<.5								124-128
PER 100 HRS								
.5								130-131
PER 100 HRS								
.7								136-141
PER 100 HRS								
.9								142-147
PER 100 HRS								
***TOTAL								
PER 100 HRS								

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 40-60%

A/S (VH)	<10	10	TORQUE (PSI) 20	30	40	50	TOTAL	FLIGHT CONDITION
<.5								148-151
PER 100 HRS								
.5								154-159
PER 100 HRS								
.7								162-167
PER 100 HRS								
.9								168-171
PER 100 HRS								
***TOTAL								
PER 100 HRS								

Figure 4. (Continued)

AIRCRAFT: 76-22574. LOG TIME: 007.6 RETRIEVAL DATE: 6/ 1/80 REASON: COMPONENT REPLACEMENT
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 37.5 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE.

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 60-80%

A/S (VH)	<10	10	TORQUE (PSI)			50	TOTAL	FLIGHT CONDITIONS
			20	30	40			
<.5								172-177
PER 100 HRS								
.5								178-183
PER 100 HRS								
.7								184-189
PER 100 HRS								
.9								190-195
PER 100 HRS								
***TOTAL								
PER 100 HRS								

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 80-90%

A/S (VH)	<10	10	TORQUE (PSI)			50	TOTAL	FLIGHT CONDITIONS
			20	30	40			
<.5								196-201
PER 100 HRS								
.5								202-207
PER 100 HRS								
.7								208-213
PER 100 HRS								
.9								214-219
PER 100 HRS								
***TOTAL								
PER 100 HRS								

Figure 4. (Continued)

SIRS SPECTRUM USAGE

PAGE 9

AIRCRAFT: 76-22574. LOG TIME: 887.6 RETRIEVAL DATE: 8/ 1/80 REASON: COMPONENT REPLACEMENT
RECORDER: 1005 BASE: 1
DELTA LOG TIME: 37.5 HOURS
(***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: >90%		TORQUE (PSI)					TOTAL	FLIGHT CONDITIONS
A/S (VH)	<10	10	20	30	40	50		
<.5							220-225	
PER 100 HRS								
.5							226-231	
PER 100 HRS								
.7							232-237	
PER 100 HRS								
.9							238-243	
PER 100 HRS								
***TOTAL								
PER 100 HRS								

Figure 4. (Concluded)

The methodology followed to solve this problem was to study AH-1G oscillograph records to determine if any of the other existing parameters could be used to determine takeoff and landing. An example of an oscillograph record showing two takeoffs and landings is shown in Figure 5. A hypothesis was formed that variables other than the original takeoff sensing channel could be used to detect takeoff and landing of the aircraft. The hypothesis was based on changes in roll angle, vertical acceleration and torque. The assumptions made in this hypothesis are as follows:

h_o (roll angle)₁ = value remains steady on the ground

h_o (roll angle)₂ = there is a detectable ripple in the roll angle during hover

h_o (n_z , vertical acceleration)₁ = value remains steady on the ground

h_o (n_z , vertical acceleration)₂ = there is a detectable ripple in the n_z signal during hover

h_o (torque)₁ = there is a typical minimum negative rate of change in the torque value while making the transition from hover to ground

h_o (torque)₂ = there is a typical minimum positive rate of change of the torque value while making the transition from ground to hover.

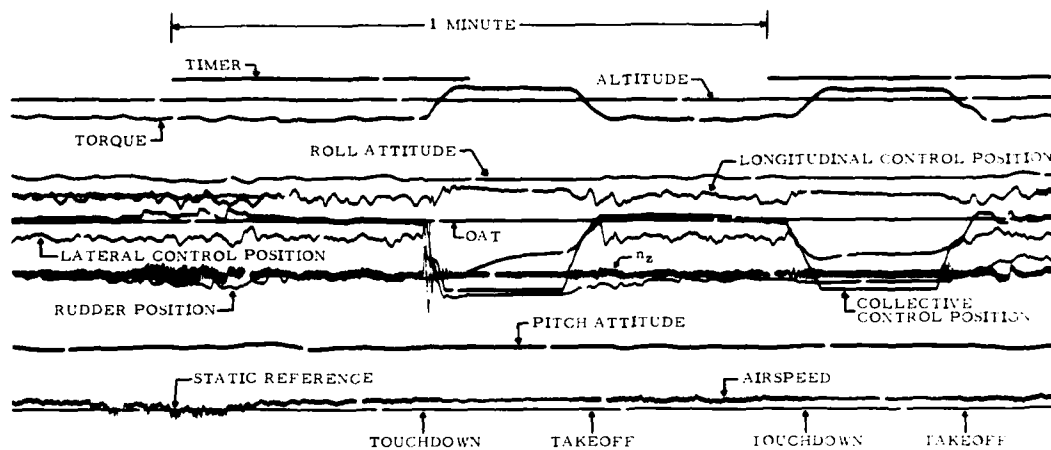


Figure 5. Example of Oscillograph Data Showing Two Takeoffs and Two Landings.

In extracting the data from the oscillograph records the period over which the traces were measured was arbitrarily limited to four time slices as shown in Figure 6.

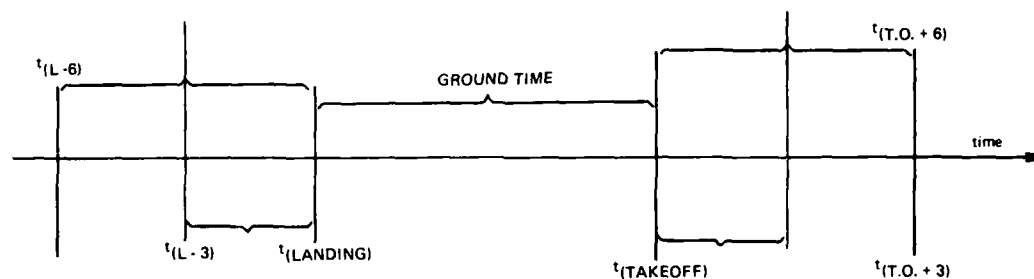


Figure 6. Definition of Time Periods Considered in Study.

$t_{(L-6)}$ = 0 to 6 seconds before landing

$t_{(L-3)}$ = 0 to 3 seconds before landing

$t_{(T.O. + 3)}$ = 0 to 3 seconds after takeoff

$t_{(T.O. + 6)}$ = 0 to 6 seconds after takeoff

In the case of " n_2 ripple" the time before landing was referenced to any large spike caused by landing skid bounce; therefore, these large spikes were not counted in the data.

In order to quantify the data for each sampling period, the amount of ripple during each time slice is defined as the maximum amplitude variation of the trace over that time period. Figure 7 shows an example of data extracted for roll for the two time periods after takeoff.

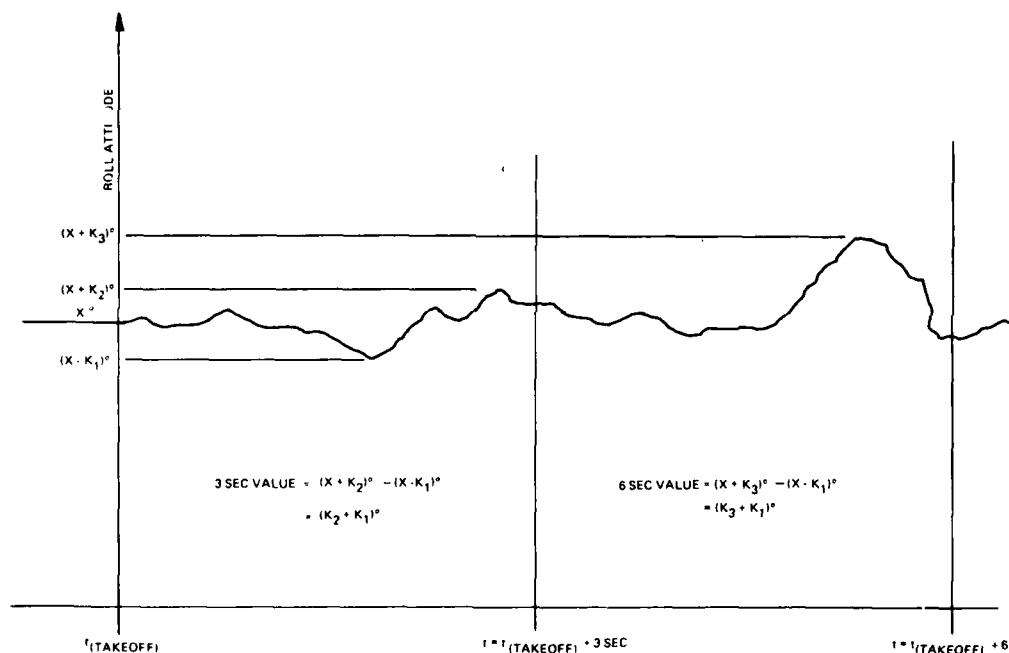


Figure 7. Example of Data Extracted for Peak-to-Peak Roll Amplitudes.

The data were extracted as described above. The goal of this investigation was to determine a suitable threshold for the roll signal above which the recorder could be triggered to indicate hover condition. An indication of the frequency at which discrete roll angles occur during takeoff and landing is shown in Figure 8.

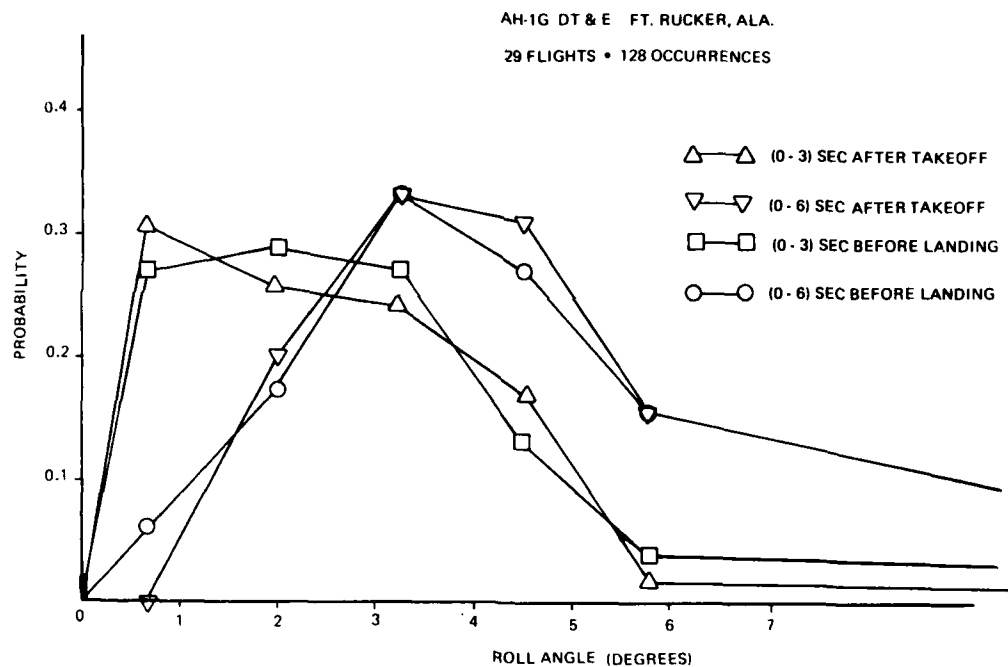


Figure 8. Frequency Polygons for Roll Angle (Degrees) 0-3 and 0-6 Seconds after Takeoff or Landing.

Since the probability of seeing any one discrete roll angle during the specified time periods is very low, the data were retabulated to determine the probability of seeing roll angle variations of any particular value or higher. The results are illustrated by the graph of Figure 9 showing the 'or more' cumulative probabilities for any angle during each time period.

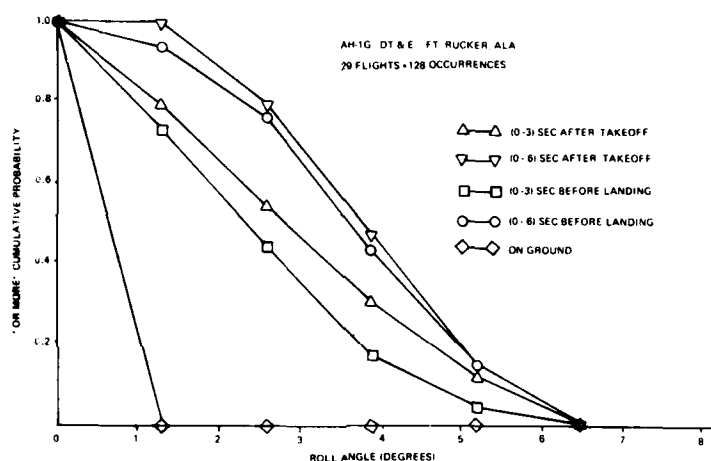


Figure 9. Distribution of Peak-to-Peak Amplitude of Roll Angle (Degrees) 0-3 and 0-6 Seconds after Takeoff or Landing.

From the graph it is evident that a threshold of between 1.5° and 2.0° would be an optimum level to distinguish between ground and hover and also yield very high probabilities of occurrence within 6 seconds of takeoff.

The resolution for the roll channel was set in such a way that 4.4 counts were equal to 1° of roll angle. As determined in the laboratory by using a prototype circuit board, the maximum signal fluctuation was ± 1 count for a given input anywhere over the roll angle range of 0° to 35° .

Conservatively, allowing a "noise error" of ± 2 counts and thus assuming a possible channel variation of 4 counts for any fixed input, a minimum change of between 1° and 2° should be detectable. However, due to the differences in signal conditioning between the oscillograph system and the SIRS recorder, the signal was amplified by a factor of 2 for the following reason: The oscillograph system used a synchro-to-DC converter, the output of which consists of positive and negative angles. The SIRS recorder detects only the absolute value of gyro angle magnitude. The maximum difference between the two systems would be a symmetrical signal about 0° reference as shown in Figure 10.

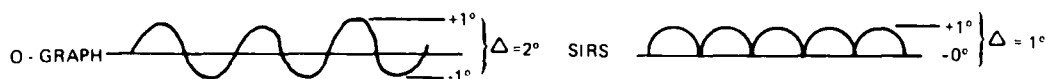


Figure 10. Comparison of Oscilloscope and SIRS Signal Conditioning Characteristics for Roll Channel Input Above 0 Degrees.

Again using a prototype board, the normal output of the roll channel amplifier was fed into another amplifier stage. Testing indicated that even with an additional gain factor of 5 the maximum output fluctuation of the "amplified roll" channel was still ± 1 count for any fixed input over the range of 0 - 10° . (Full scale is approximately $10^\circ = 44$ counts $\times 5 = 220$ counts.)

Vertical acceleration (n_z) data were extracted from the oscillograph records in the same way as the roll data were extracted. The data were tabulated in the same manner and the corresponding "or more" accumulative probability graph is shown in Figure 11.

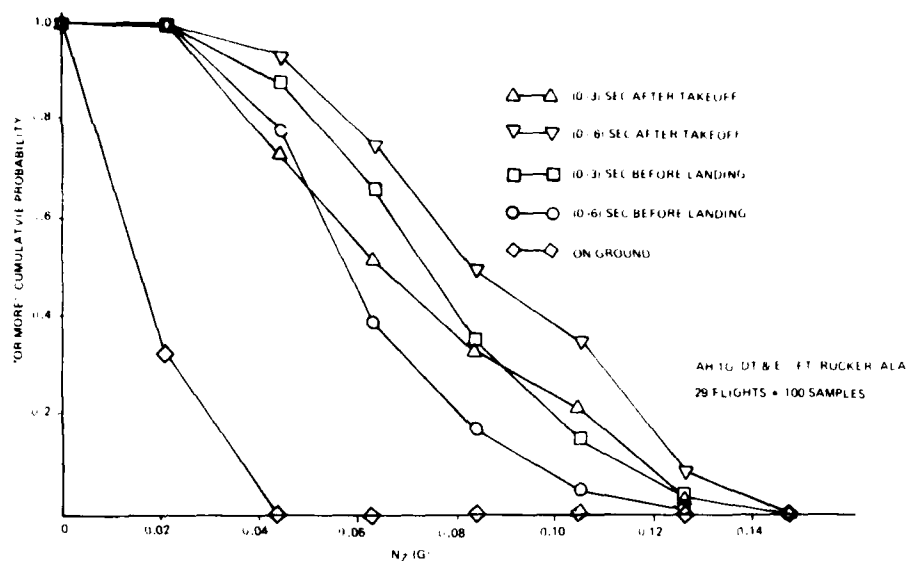


Figure 11. Distribution of Peak-to-Peak Amplitude of Vertical Acceleration (n_z) with Sampling Times.

The resolution of the vertical acceleration channel, n_z , is set such that 6 counts are equal to 0.1 G. For a given fixed input to the prototype board over the full range of the n_z channel (-2 G to +2 G) the maximum signal fluctuation was ± 1 count. By conservatively doubling the possible "noise error" to ± 2 counts, giving a channel variation of 4 counts for any fixed input, it is possible to detect a minimum variation of 0.067 G. Therefore, the n_z channel can be used in its present configuration to detect stability in the n_z signal at hover. However, given this resolution, from the probability graph shown in Figure 11 it can be seen that the vertical acceleration channel n_z becomes a backup signal for detecting hover as compared to the roll signal. This is due to the fact that the probabilities of occurrence of variations above 0.067 G are in the 70 percent or less category.

Torque pressure rates of change during takeoff and landing are shown in Figure 12.

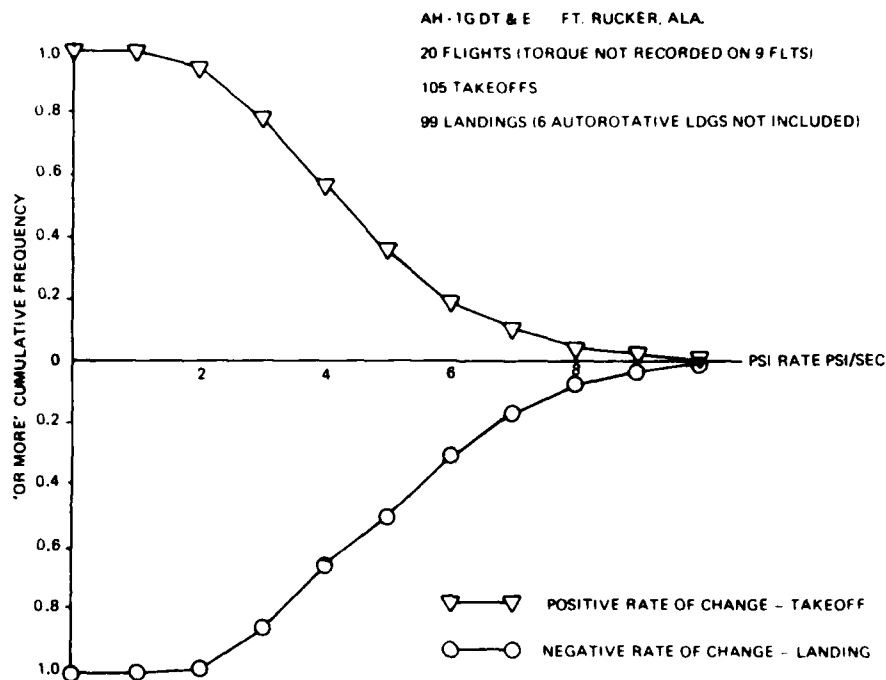


Figure 12. Torque Pressure Behavior During Takeoff and Landing.

The resolution of the torque channel is set such that 2 counts correspond to 1 psi. For a given fixed input to the prototype circuit board over the full range of the torque channel, the maximum signal fluctuation was ± 1 count. Assuming a doubling of this "noise error" to ± 2 counts, giving a possible channel variation of 4 counts for any fixed input, torque slopes of 2 psi/sec or greater can be detected. This rate, as shown in the graph above, falls within a high probability of occurrence during takeoff and landing.

Takeoff and Landing Logic

As a result of the foregoing data it was determined that takeoff and landings could be detected by combining the characteristic behavior of the roll, n_z , and torque signals into an algorithm that could be programmed into the recorder. Logical flow diagrams and the corresponding software routines were developed. The existing recorder software program was modified to accommodate the new algorithms and a new set of firmware was installed in each recorder for testing and further data collection in March 1980.

The logical flow diagrams (Figures 13 and 14) and associated notes for both the new takeoff detection and landing detection algorithms are contained in the following pages.

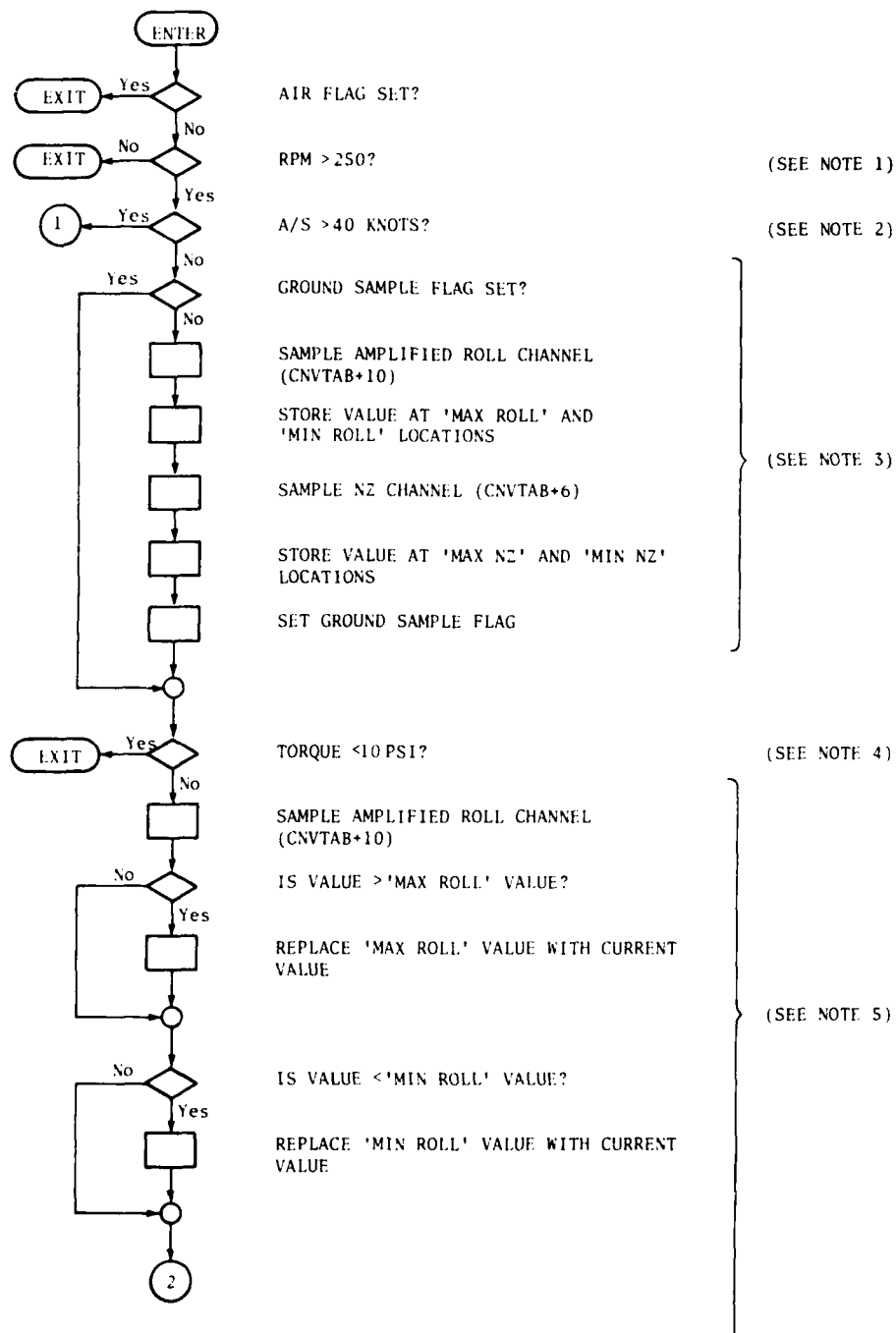


Figure 13. Takeoff Logic Flow Diagram.

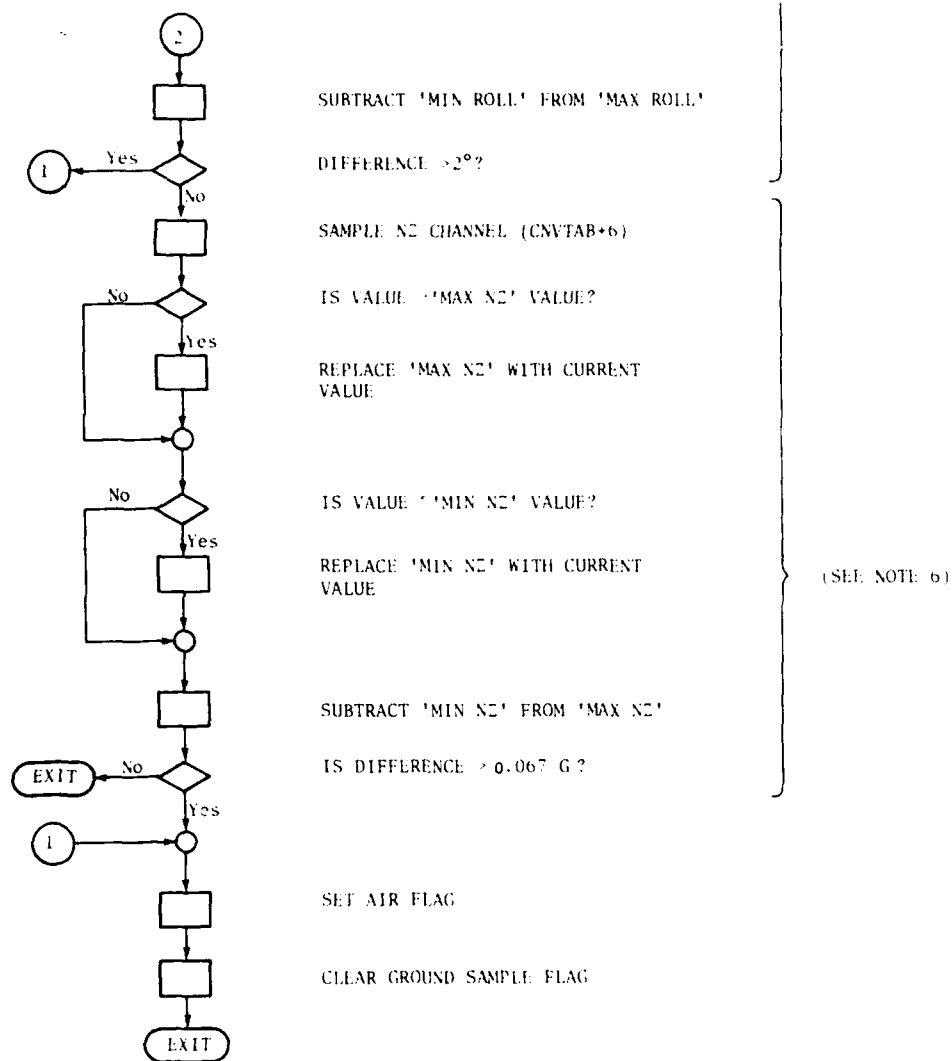


Figure 13. (Concluded)

o Takeoff Logic Notes

1. On the first takeoff after power-up, a restriction that RPM be above 250 ensures that the roll gyro will have already stabilized. (The gyro stabilizes much faster than it takes for the engine to get up to speed.)
2. If A/S rises above 40 knots, the air flag will be set. This is a safety valve used if takeoff is not detected below.
3. These values for roll and n_z will be the starting stable values against which subsequent values will be compared. Once they are stored, the ground sample flag is set and this portion of the logic is not entered again until after takeoff and landing has occurred. (Landing logic clears air flag.)
4. The rotor has no lift until torque starts building up. (This threshold value is used in the current software in much the same way.) If torque is less than 10 psi, no attempt will be made to look for a takeoff.
5. This logic keeps a running history of the highest and lowest roll angles observed. The result obtained by subtracting minimum roll from maximum roll is the maximum peak-to-peak roll amplitude observed since the ground sample flag was set. If this result exceeds 2° , the air flag will be set and the ground sample flag cleared. If the result does not exceed 2° , a check will be made on the n_z channel. This is effectively an "or" function. Roll or n_z can trigger the air flag.

6. This logic keeps a running history of the highest and lowest n_z values observed. The result obtained by subtracting minimum n_z from maximum n_z is the maximum peak-to-peak vertical acceleration observed since the ground sample flag was set. If this result exceeds 0.067 G then the air flag will be set and the ground sample flag cleared. If the result does not exceed 0.067 G then no action will be taken during this sampling period (i.e., no takeoff flagged).

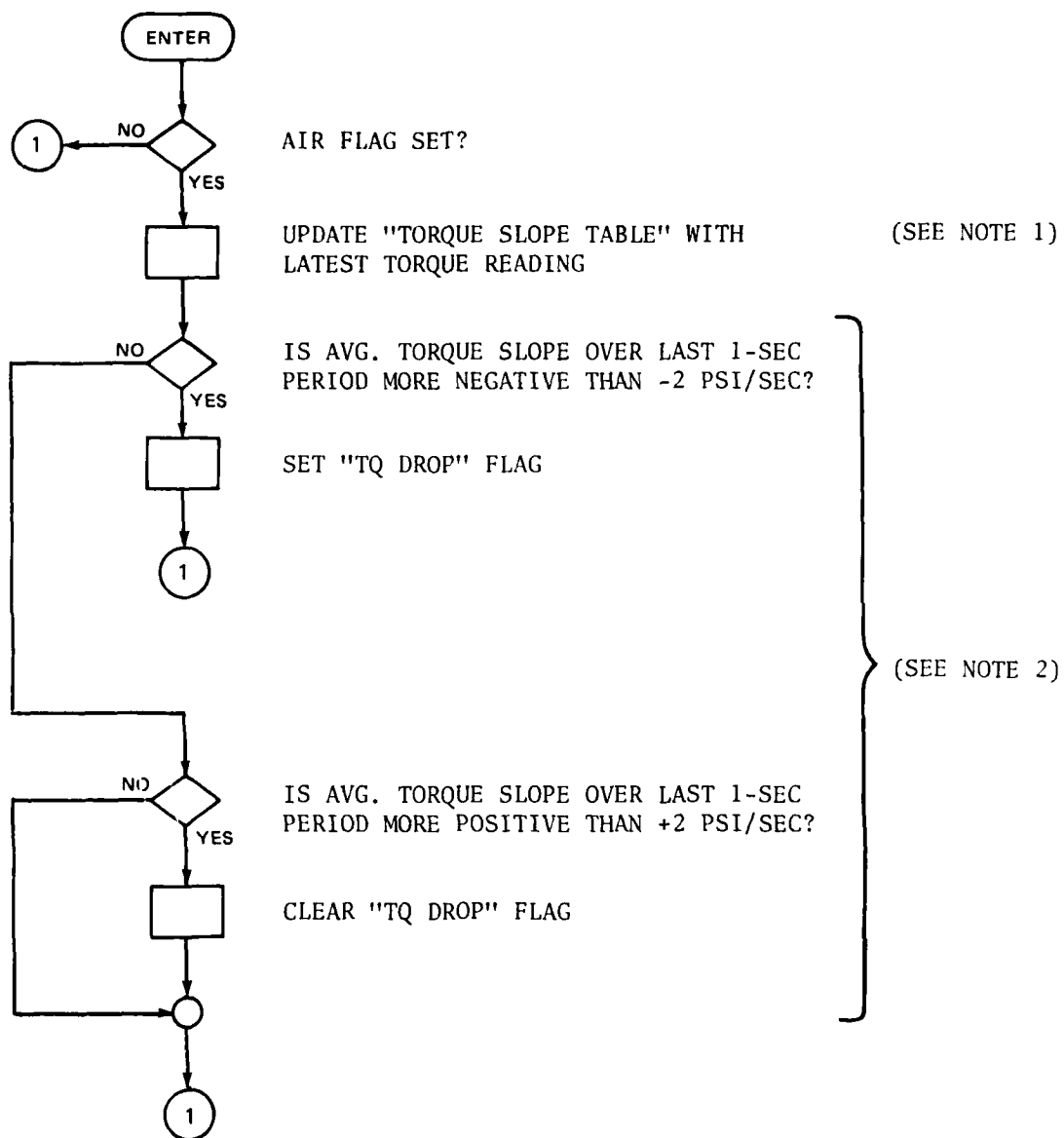


Figure 14. Landing Logic Flow Diagram.

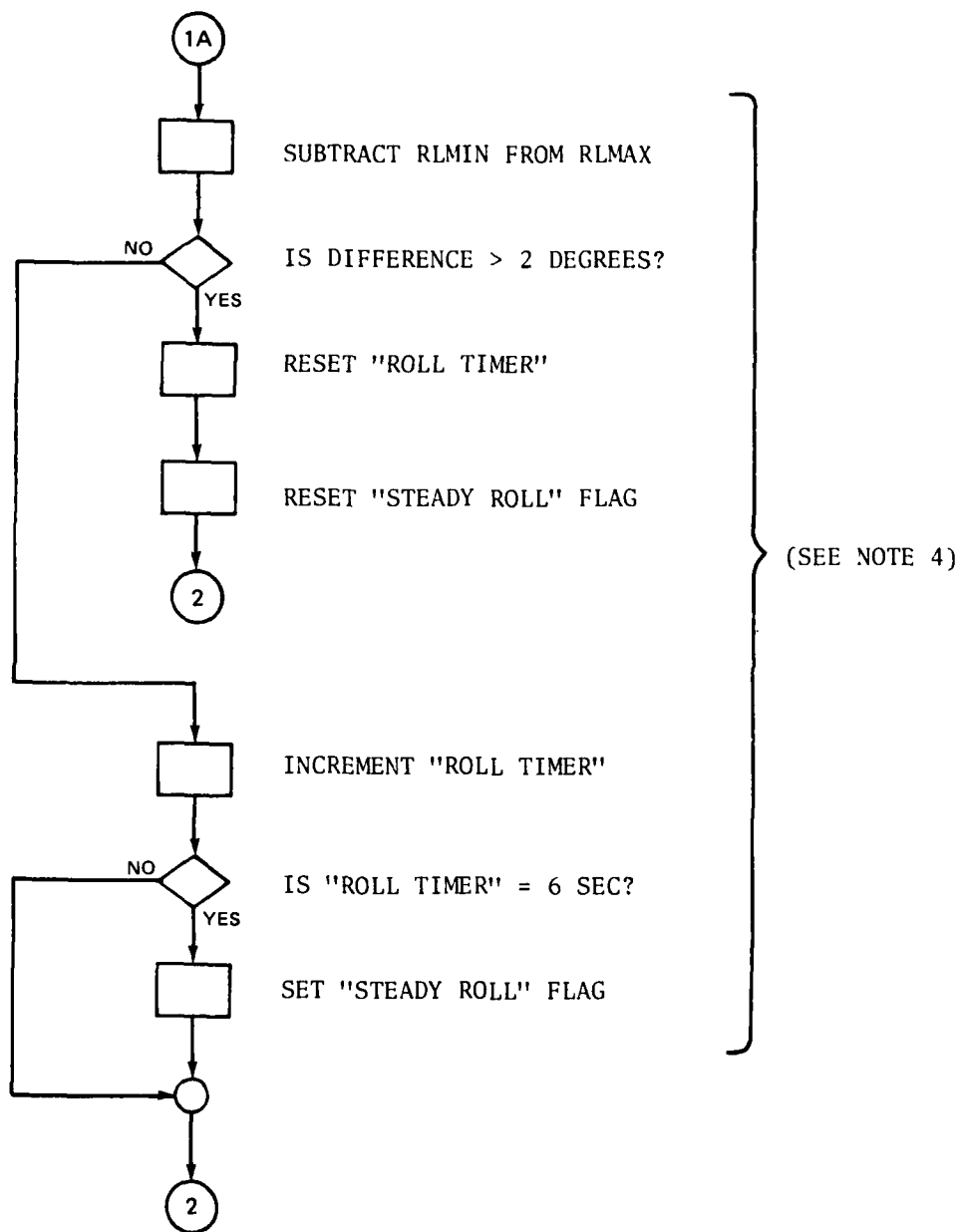


Figure 14. (Continued)

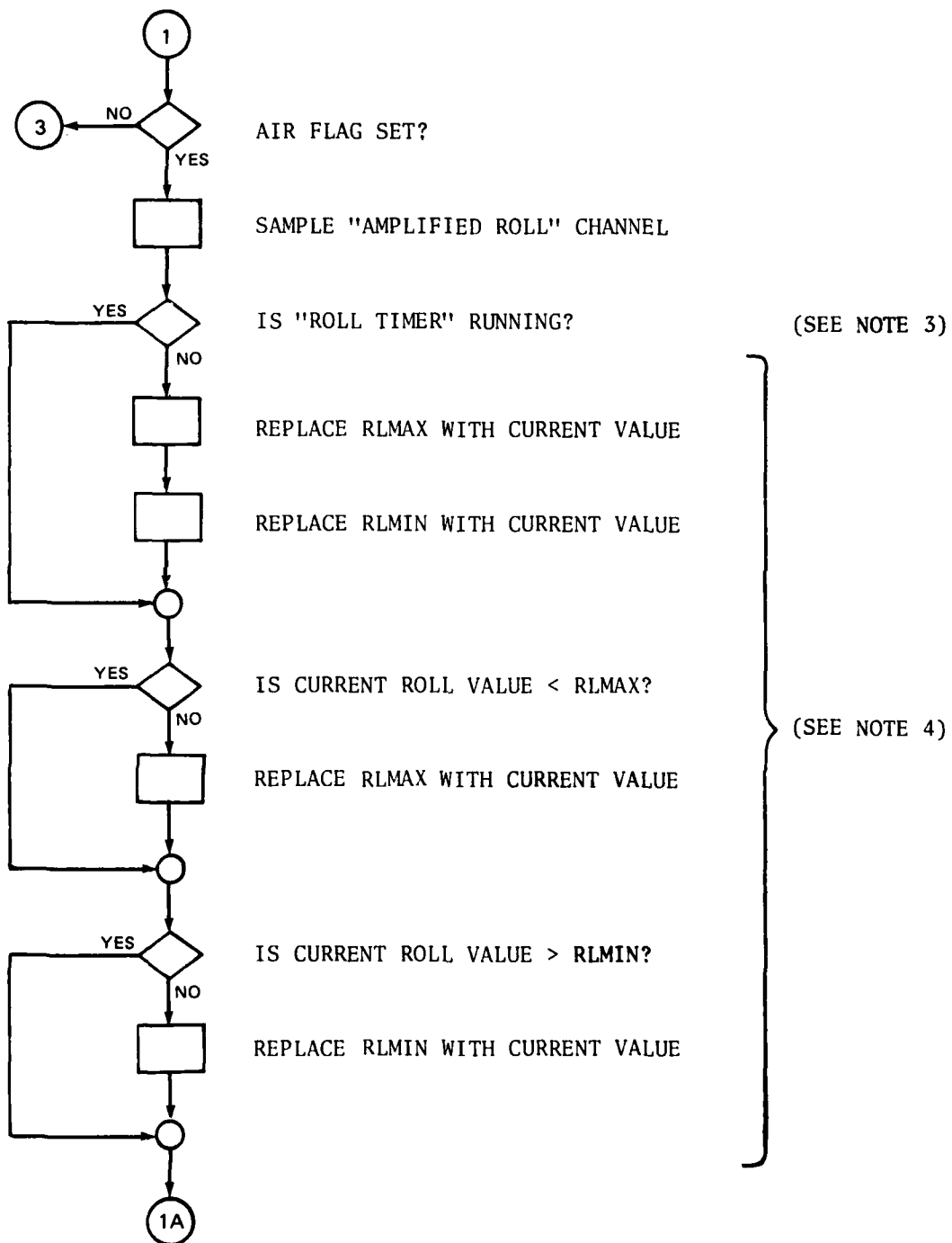


Figure 14. (Continued)

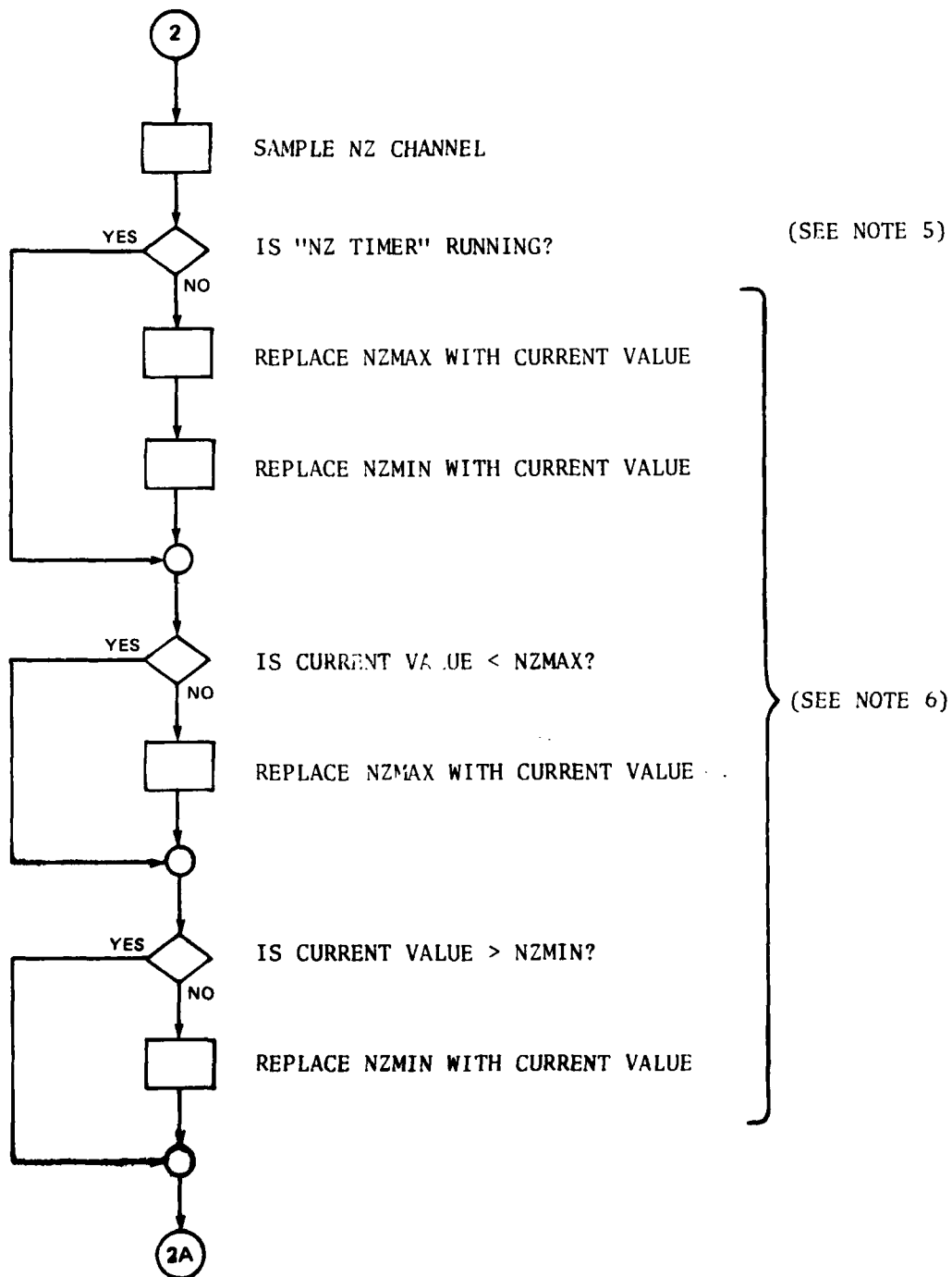


Figure 14. (Continued)

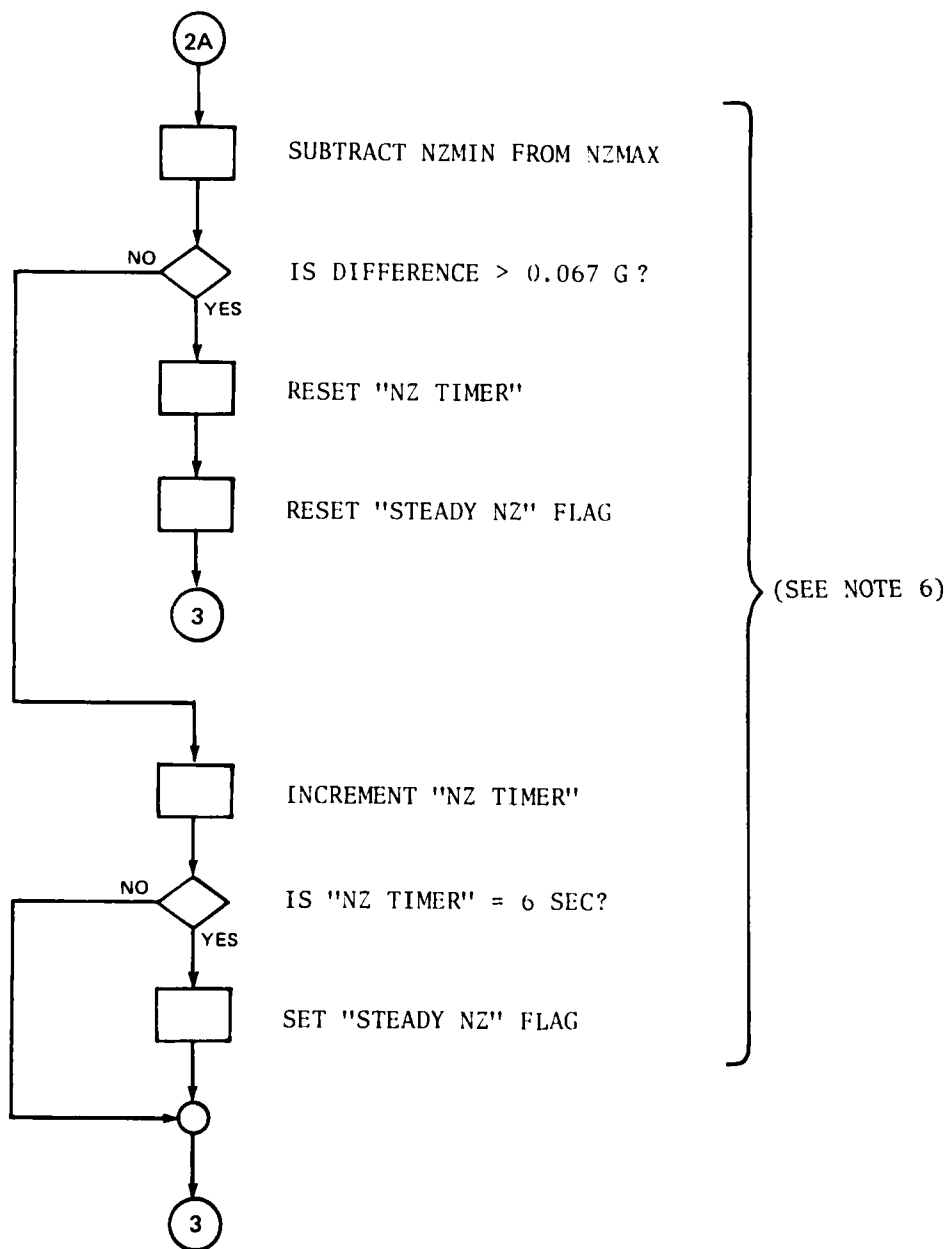


Figure 14. (Continued)

6
F

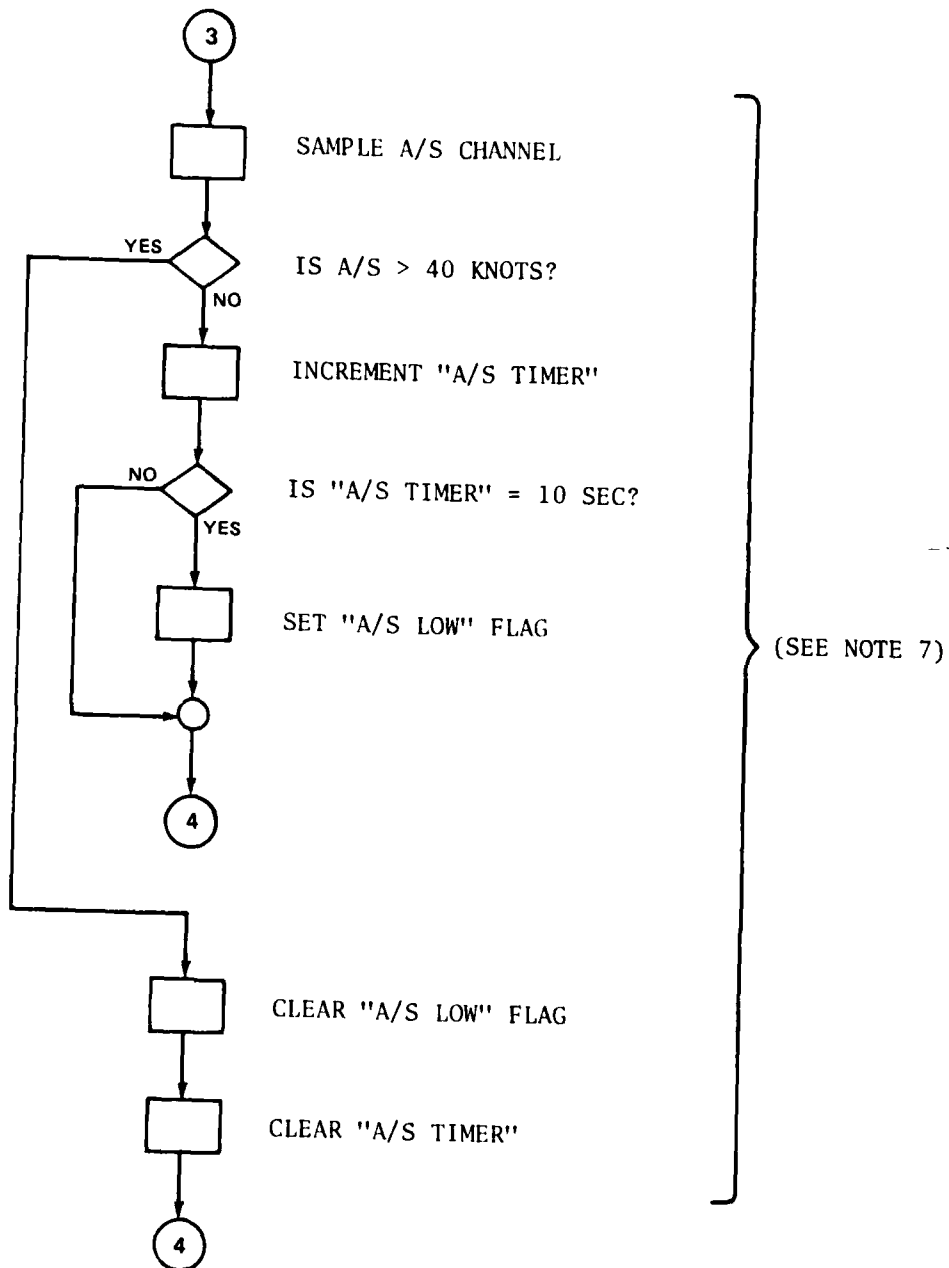


Figure 14. (Continued)

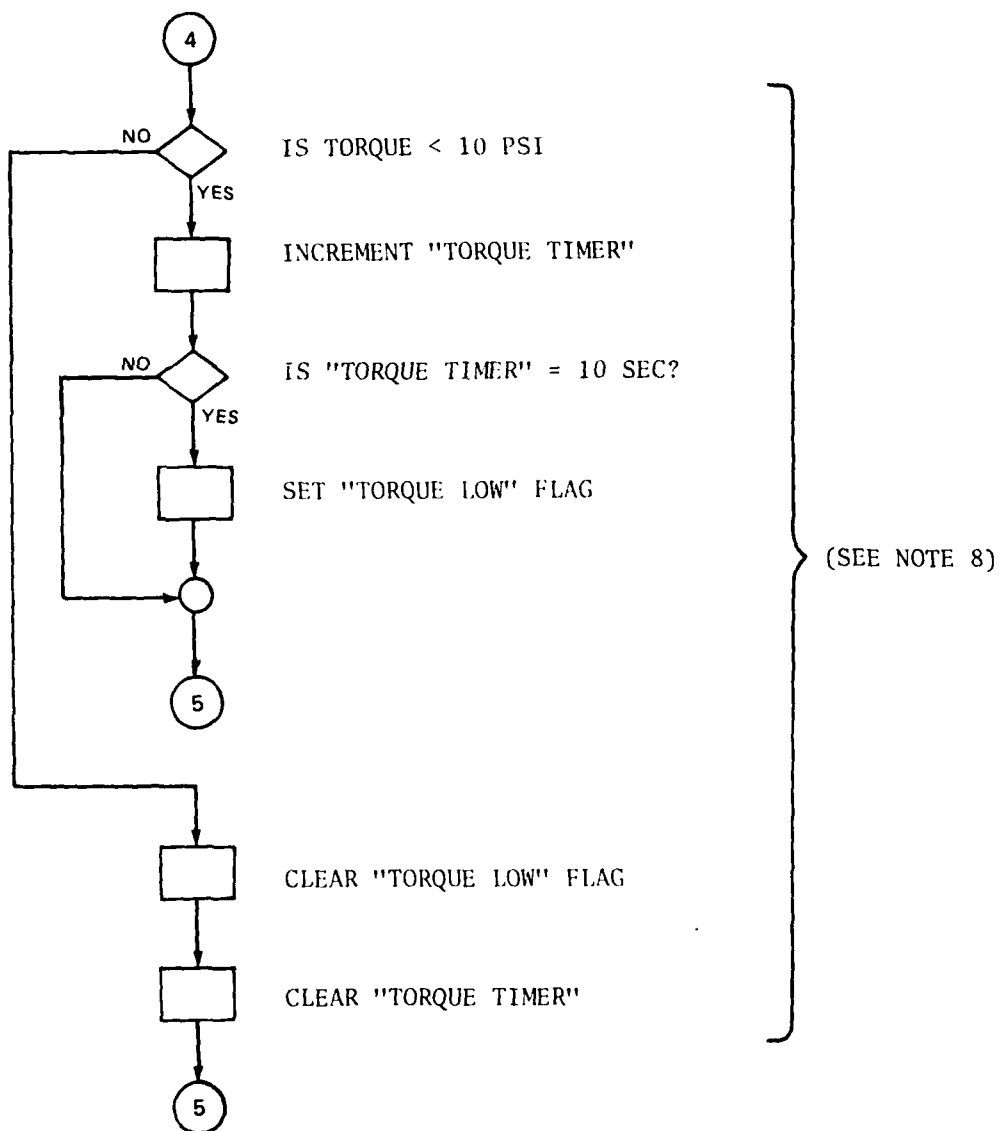


Figure 14. (Continued)

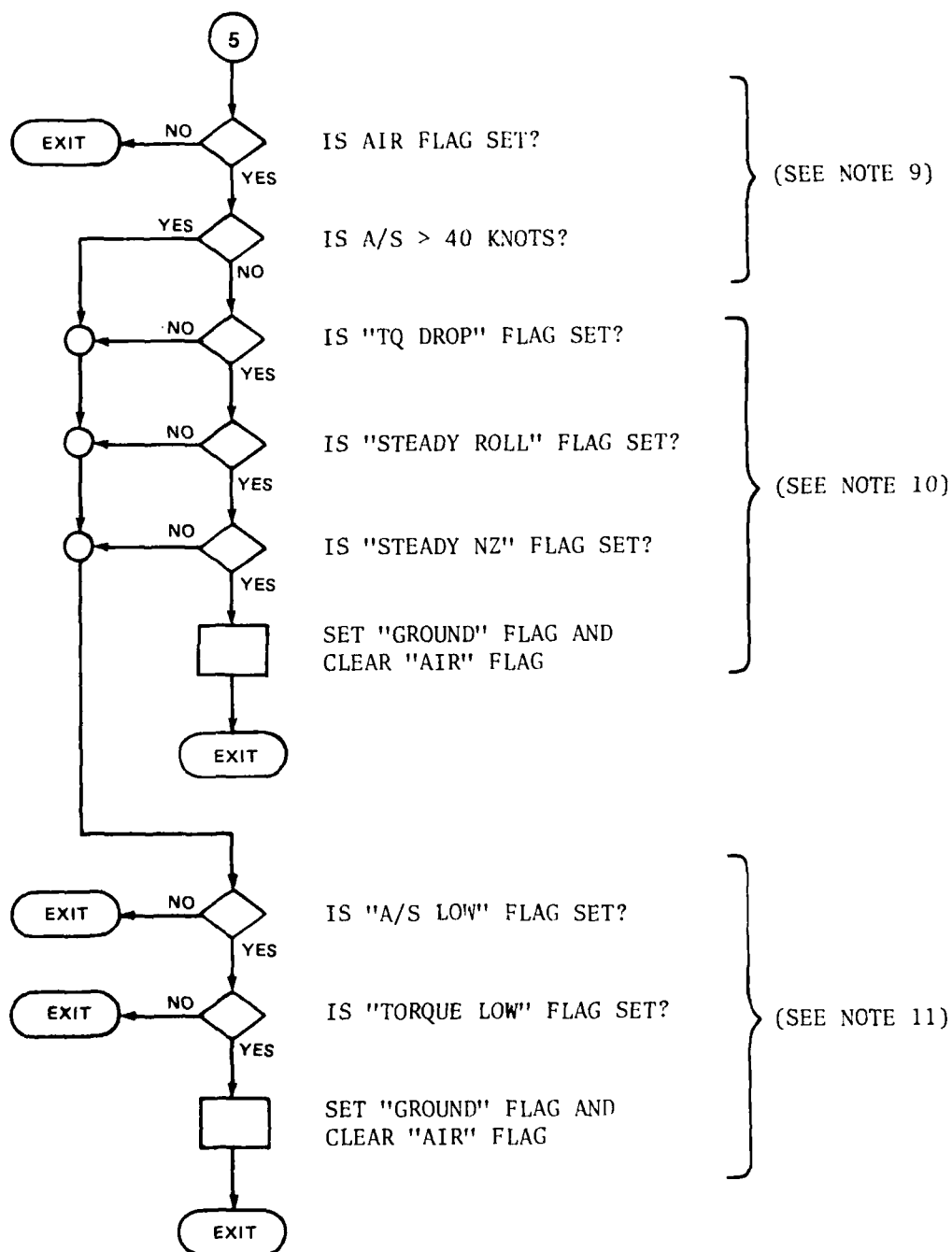


Figure 14. (Concluded)

o General Landing Logic Notes

During a normal landing, roll and n_z become stable and then torque usually drops off quickly. (See Figure 15.)

During an autorotative landing, torque drops off quickly while airspeed is high. Torque does not increase thereafter at any high rate of change (large possible torque slope).

A transition from autorotation to powered flight is characterized by a high positive torque slope. This occurrence should clear any possible considerations for either type of landing (auto or norm) criteria being satisfied.

Anytime airspeed >40 knots, no test for stable roll and n_z should be performed (i.e., no landing can be accomplished).

There should be a default landing safety value (i.e. if both torque remains $<X$ psi and airspeed remains $<Y$ knots for at least Z seconds, then a landing should be forced regardless of any tests made on roll and n_z).

To allow for different final ground values for roll angle and n_z value, there should be memory locations that are constantly being updated and then used for tests for final values.

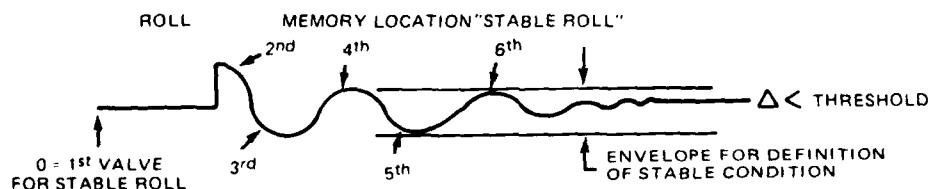


Figure 15. Roll Signal Characteristics on Landing.

o Landing Logic Notes

1. The torque slope table is a 10-byte first-in-first-out stack used to keep a running 1-second past history of the channel. Since the recorder channels are sampled 10 times per second, the torque value at the bottom of the stack is the torque value 1 second ago and the torque value at the top of the stack is the current torque value; therefore, the average torque slope over the last 1-second period is:

$$\text{TQ Slope Avg} = \frac{\text{TQ}_{\text{Bottom}} - \text{TQ}_{\text{Top}}}{1 \text{ Second}} = (\text{TQ}_{\text{Bottom}} - \text{TQ}_{\text{Top}}) \text{ psi/sec}$$

2. This section of logic tests how quickly and in what direction the torque signal is changing. If the signal is changing at a rate of -2 psi/sec or more negatively, a TQ DROP flag will be set. If the signal is changing at a rate of +2 psi/sec or more positively, this same flag will be reset. If the torque slope remains between -2 psi/sec and +2 psi/sec, no action will be taken.
3. ROLL TIMER is a memory location that is used to accumulate counts representing 0.1 second each. This counter can be incremented each time this logic is entered.
4. This portion of the logic is designed to indicate when the roll input signal has remained below a 2-degree peak-to-peak excursion for a minimum duration of at least 6 seconds. If this criterion is met, the STEADY ROLL flag is set. If, however, the roll angle excursion

exceeds 2 degrees at any time, the ROLL TIMER and STEADY ROLL flag will be reset and the timing process reinitiated.

5. NZ TIMER is used to perform the same function as ROLL TIMER. It is a memory location used to accumulate counts, each having a weight of 0.1 second.
6. This portion of the logic is designed to indicate when the n_z input signal has remained below a 0.067-G peak-to-peak excursion for a minimum duration of at least 6 seconds. If this criterion is met, the STEADY NZ flag is set. However, if at any time the n_z channel excursion exceeds 0.067 G, the NZ TIMER and STEADY NZ flag will be reset and the timing process reinitiated.
7. This portion of the logic monitors the airspeed channel and determines when airspeed has been continuously below 40 knots for a period of at least 10 seconds. If this criterion is met, an A/S LOW flag is set. This flag is then later used in a test to determine whether a default landing should be forced.
8. This portion of the logic is equivalent to the airspeed monitoring logic above. It monitors the torque channel and determines when torque has been continuously below 10 psi for a period of at least 10 seconds. If this criterion is met, a TORQUE LOW flag is set. This flag is later used in a test to determine whether a default landing should be forced.

9. If the AIR flag is not set and if airspeed is above 40 knots, no attempt will be made to check for a normal landing or a default landing.
10. This portion of the logic determines whether conditions for a normal landing have been satisfied. A logical AND of the TQ DROP, STEADY ROLL, and STEADY NZ flags is required to indicate a landing.
11. This portion of the logic determines whether conditions for a default landing have been satisfied. A logical AND of the A/S LOW and TORQUE LOW flags is required to indicate a landing.

GROSS WEIGHT MEASUREMENT

Measurement of AH-1S helicopter gross weight by means of sensors attached to the lift link proved to be unsuccessful since it was not possible either to satisfactorily bond strain gages to shot-peened surfaces or to securely clamp a piezoelectric strain-sensing device to the lift link. Vibratory loads on the link have a particularly adverse effect on attachment by clamping, due to slippage and associated zero shifts in the sensor output. This approach had to be abandoned since stable readouts could not be consistently obtained. Further work will be needed to obtain a reliable gross weight measuring system. However, it is felt that this can be achieved by selection of the proper sensors and proven attachment techniques.

In view of the problems discussed above it was decided to continue with the recorder development testing program without the gross weight parameter. This approach was

The elimination of the gross weight channel necessitated the previously mentioned study of other signals for initiation of the recording cycle.

Inconsistencies occurred in the peak RPM indication, which required a review of the RPM detection circuitry shown in Figure 16. The data of Figure 4 show a typical occurrence in that the peak RPM recorded for the period is 360.8 RPM. This is the maximum value that can be resolved by the recorder; this value occurred so often in the data collection periods that an effort was made to determine if the RPM channel was functioning properly.



This RPM detection circuit works well once rotor tachometer signals are generated. However, if at the instant power is supplied to the recorder the trigger flip-flop comes up in the "zero" state, the multistage counter output (Q12) can be zero volts and remain there until an input signal arrives. Since zero volts DC at the input to the analog-to-digital converter is interpreted as maximum RPM, the high value read under these circumstances is erroneously stored by the microprocessor as the peak RPM value for the recording period.

In order to overcome this deficiency an additional function was added to the circuit. This function presets the trigger flip-flop to the desired state under program control after power is applied to the recorder but before the channel is sampled. Figure 17 is an illustration of the modified RPM detection circuit.

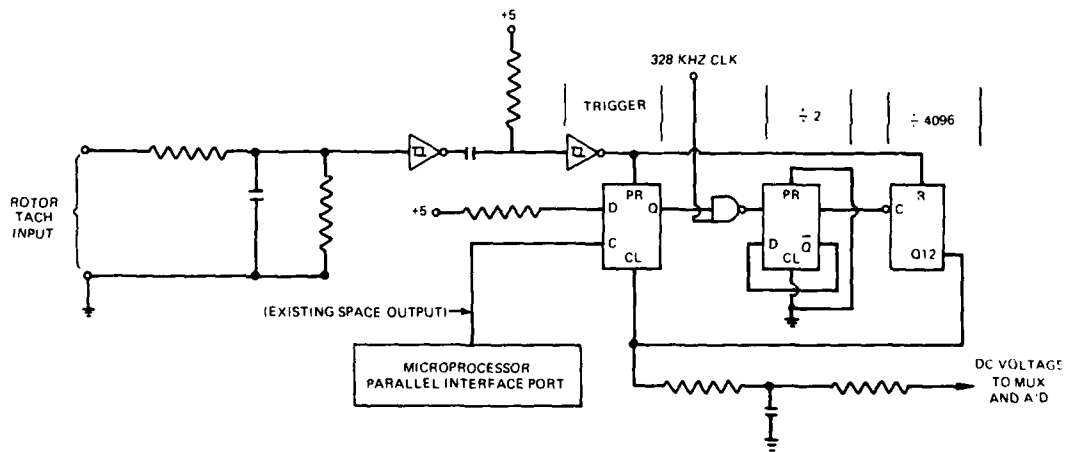


Figure 17. Modified RPM Detection Circuit.

The following modifications were incorporated in the circuit:

1. The "D" input of the trigger flip-flop was connected to +5 volts.
2. The "C" input of the trigger flip-flop was tied to an existing spare output from the parallel interface port.
3. Under software control, right after power is supplied to the recorder, the "C" input will be pulsed, thus presetting the trigger flip-flop to a "one" state.
4. The 328 kHz clock will then drive the "divide by 2" and "divide by 4096" sections allowing the multistage counter, Q12, to go to a "one" state until a signal from the rotor tachometer arrives. This represents minimum RPM.

With the above hardware modifications, changes to the recorder firmware were made to set bit B4 of the parallel interface adapter during the recorder initialization routines that are entered when power is applied. The first time the recorder's analog-to-digital conversion subroutine is entered, the B4 bit is reset and remains there as long as power is available to the recorder.

MULTIPLEXER BLEED-THROUGH

The problems encountered with the lift-link-mounted gross weight sensor also revealed another recorder hardware problem. When the output of the sensor shifted to the point where large inputs were present at the gross weight channel

amplifier, the readings from the other channels were affected. Figure 18 is a functional diagram depicting the nature of the problem.

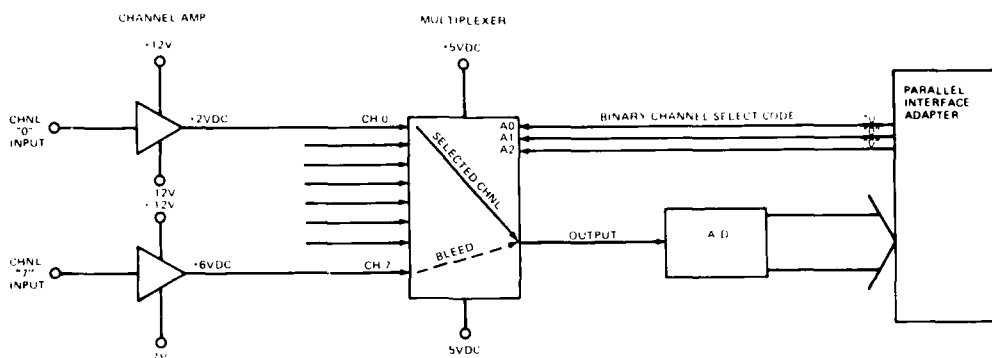


Figure 18. Example of Multiplexer Cross-Talk Problem.

The multiplexer was biased with +5 volts DC power supplies. The maximum possible output from the channel amplifiers was +10 volts DC. Normally, the selected channel's output (channel "0" in this example) is switched to the multiplexer's output where an analog-to-digital conversion is made. However, if any other channel's output is outside the range of +5 volts DC (channel "7" in this example) it will bleed through the multiplexer and either increase or decrease the selected channel's (channel "0" in this example) reading. In this case the digital conversion for channel "0" would indicate a higher value than would be expected for a normal conversion of +2 volts DC.

The implications of the bleed-through problem were that any one channel could erroneously raise or lower all of the recorded peak values. If any one channel malfunctioned, all flight condition category data would be suspect instead of only the flight condition categories directly associated with the faulty channel. In addition, maintenance efforts were hampered in that monitoring any and all of the channels with the retrieval unit would not reveal the faults since all readings would be erroneous.

In order to solve this problem the original multiplexers had to be replaced with ones having input over-voltage protection. Substitute multiplexers were available that provided protection up to ± 15 volts DC beyond the bias supplies or in this case an operating range of ± 20 volts DC on the inputs.

Tests were performed on a prototype board to ascertain that the bleed-through problem was corrected. In addition, checks were performed to assure that conversion values and settling time requirements were not affected by the new multiplexers.

As a result of this testing, it was determined that the increased "on" impedance of the new multiplexers required changing certain of the channel span resistors. Figure 19 is an example of a channel that has a full-scale analog-to-digital conversion value of 255 counts when the amplifier output is equal to 4.99 volts VDC.

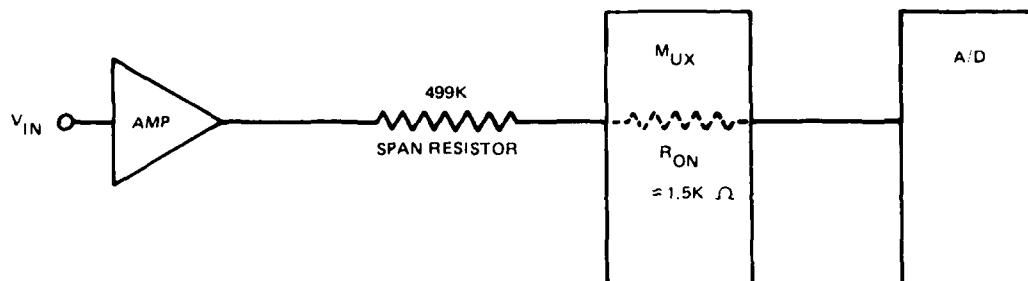


Figure 19. Example Showing "On" Impedance of New Multiplexer (4.9 Volts, Full-Scale Channel).

Figure 20 is an example of a channel that has a full-scale analog-to-digital conversion value of 255 counts when the amplifier output is equal to 0.866 volts DC.

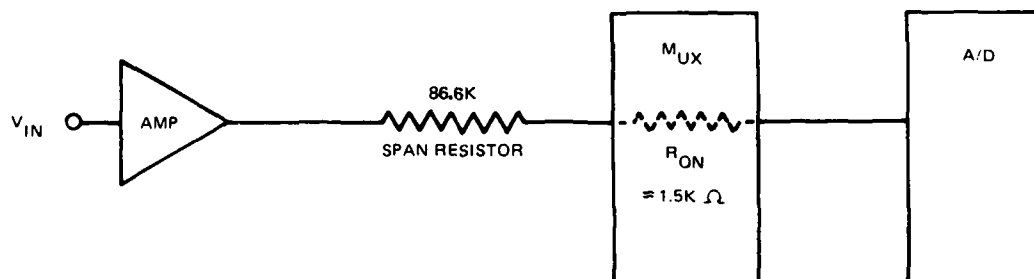


Figure 20. Example Showing "On" Impedance of New Multiplexer (0.866 Volts, Full-Scale Channel).

Each series span resistor sets the full scale for the channel because the analog-to-digital converter used senses input current rather than voltage levels. Full-scale readings of 255 counts are given by 10 μ amps DC. This testing revealed that only the lower value resistors in two channels needed to be changed.

The new multiplexers fulfill the requirements of this application when the resistance of the low value span resistors is decreased by 1.5 K ohms to compensate for the added multiplexer impedance.

TORQUE MEASUREMENT SPLIT

A difference in indication between the pilot's and copilot's torque indicators was observed. A 2-4 percent higher reading was observed on the copilot's instrument. The apparent cause for this discrepancy was the load imposed by connecting the SIRS recorder in parallel with the pilot's indicator. The solution to this problem was to increase the input impedance of the torque signal and torque reference amplifier channels in the recorder.

The signal conditioning board of the recorder had spare slots for operational amplifiers in the area of both channels. Operational amplifiers were added to each channel input in a voltage follower configuration. This provided the channels with a very high input impedance, thus eliminating the problem.

RECORDER SYSTEMS PERFORMANCE AND CONCLUSIONS

Data retrieval started during February 1979, with four recorders installed, and continued until August 1980. The fifth recording system was installed in October 1979. The data retrieved between February 1979 and April 1980 were taken with the original system hardware and software. Data retrieved between May 1980 and August 1980 were taken with the modified system as discussed previously.

Appendix B contains data printouts from four aircraft involved in the "J-CATCH" mission conducted during March 1979. Data from two aircraft, tail numbers 76-22571 and 76-22568, appear to be satisfactory and to confirm the proper functioning of sensors and the recording system. However, the first indication of problems with the gross weight measuring system is evident on aircraft #76-22574 since all data retrieved registered in the lowest gross weight category. A proper distribution of the data should have indicated time spent in all three gross weight categories. Aircraft #76-22569 did not fly, only ground runups were performed.

The quality of all the data retrieved after the "J-CATCH" mission progressively deteriorated as indicated by Figure 4. The gross weight sensor had slipped enough to indicate no liftoff, with the result that all time was recorded as ground time with no other in-flight data entries. These data were the last collected before the enhancements were undertaken. The gross weight measurements with the instrumented lift link had to be abandoned to avoid interference with the data-gathering process from other sensors.

The difficulties with the lift link consisted primarily of sensor attachment problems. Further development work with the sensor system is required to increase its reliability and accuracy.

Also, the data included in Appendix B were reprinted to show the actual peak values retrieved from the recorder since it was discovered that a problem existed with the in-house report-generating software after the original data were submitted. The problem was that, although the flight condition category data were properly subtracted from the previous month's data and printed out, the peak values from the preceding batch of data were erroneously inserted in the monthly reports. The data contained in this report have been corrected.

After the enhancements, the recording system installed on aircraft 76-22568 malfunctioned. These malfunctions could not be corrected on site before the data collection period ended. However, data were reliably collected from the other four aircraft. During the time span between April 1980 and August 1980 the hardware and software modifications were in place and data were accumulated in the recorders. Figure 21 contains a data printout for aircraft 76-22570. Appendix C contains all data collected for the month of June 1980. A significant improvement in data quality is evident in these printouts. The total amount of recording time from Figure 21:

flight time	9.6 hours
+ <u>ground time</u>	<u>2.3 hours</u>
total time	11.9 hours

agrees quite well with accrued logbook time of 12.8 hours. It is apparent that a significant portion of total helicopter usage is spent in the ground time category (19.33 percent in this case). This partially explains one of the questions outstanding from the preceding AH-1G program. During the AH-1G program, discrepancies between recorded flight time and logbook hours could not be explained. Ground time was not recorded in that program; therefore, no concept of the amount of time spent on the ground with rotor speed above 250 RPM was realized.

7
F The recording of flight time versus ground time depends on the proper signals being detected to yield accurate operational time data as a basis for cumulative fatigue damage evaluation. A limited flight test program would be required to verify or possibly improve the accuracy of the present takeoff/landing algorithm.

Also, these data indicate a peak RPM value of 336.0 RPM. The occurrences of full-scale readings of 360.8 RPM were significantly reduced, although they were still occasionally recorded. At this time it is felt that the RPM circuit modification did solve a basic recorder problem, but occurrences of 360.8 RPM or higher may actually have happened. This is a subject that will have to be further investigated under more controlled circumstances.

The recorded data intermittently indicated high peak values of n_z . In addition, during operational system check-out at the time of data retrieval some of the accelerometers appeared to be stuck at full-scale deflection. This symptom

could be corrected by tapping the accelerometer. The performance of the accelerometers deteriorated due to environmental conditions and could be improved by use of hermetically sealed units.

Operational experience with the recorders has shown that the power drain on the lithium batteries used in the memory circuits was higher than expected and reduced the battery life to about 6 months instead of the 1-year period projected. The recorder circuitry can be modified to lower battery drain. In addition, new nonvolatile memory components requiring no power source are available and could be considered for application in the SIRS recorder.

All of the problems encountered after the modifications are minor except for the requirement to monitor aircraft gross weight. Therefore, given the additional effort of completing the work required on the lift-link gross weight sensor the SIRS recorder system has reached a stage of development and performance such that IOT&E status can be considered.

7
B

SIRS SPECTRUM USAGE

PAGE 1

AIRCRAFT: 74-22572 LOG TIME: 062.7 RETRIEVAL DATE: 20/7/87 REASON: SCHEDULED
 RECORD: 1007 BASE: 2
 DELTA LOG TIME: 12.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL	PER 100 HOURS	OCCURRENCE RETRIEVAL	PER 100 HOURS
GUN TURN <.5 VH	TOTAL	0.0	0.1		
1	<7750	0.0	0.0		
2	7750-8750	0.0	0.1		
3	>8750	0.0	0.0		
GUN TURN .5-.7 VH	TOTAL	0.0	0.3		
4	<7750	0.0	0.0		
5	7750-8750	0.0	0.3		
6	>8750	0.0	0.0		
GUN TURN .7-.9 VH	TOTAL	0.0	0.0		
7	<7750	0.0	0.0		
8	7750-8750	0.0	0.0		
9	>8750	0.0	0.0		
GUN TURN >.9 VH	TOTAL	0.0	0.0		
10	<7750	0.0	0.0		
11	7750-8750	0.0	0.0		
12	>8750	0.0	0.0		
GUN S TURN <.5 VH	TOTAL	0.0	0.0		
13	<7750	0.0	0.0		
14	7750-8750	0.0	0.0		
15	>8750	0.0	0.0		
GUN S TURN .5-.7 VH	TOTAL	0.1	1.0		
16	<7750	0.0	0.0		
17	7750-8750	0.1	1.0		
18	>8750	0.0	0.0		
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0		
19	<7750	0.0	0.0		
20	7750-8750	0.0	0.0		
21	>8750	0.0	0.0		
GUN S TURN >.9 VH	TOTAL	0.0	0.0		
22	<7750	0.0	0.0		
23	7750-8750	0.0	0.0		
24	>8750	0.0	0.0		
BOYER <.5 VH	TOTAL	1.2	12.6		
25	<7750	0.0	0.0		
26	7750-8750	1.2	12.6		
27	>8750	0.0	0.0		
CRUISE .5-.5 VH	TOTAL	0.4	4.2		
28	<7750	0.0	0.0		
29	7750-8750	0.4	4.2		
30	>8750	0.0	0.0		

Figure 21. Example of SIRS Spectrum Usage Data After Modifications.

SIRS SPECTRUM USAGE

PAGE 2

AIRCRAFT: 76-22570 LOG TIME: 684.7 RETRIEVAL DATE: 20/ 6/68 REASON: SCHEDULED
 RECORDER: 1807 BASE: 2
 DELTA LOG TIME: 12.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE	
		RETRIVAL	PER 100 HOURS	RETRIVAL	PER 100 HOURS
CRUISE .5-.4 VH	TOTAL	1.3	13.0		
31	<7750	0.0	0.0		
32	7750-8750	1.3	13.0		
33	>8750	0.0	0.0		
CRUISE .6-.7 VH	TOTAL	2.2	22.5		
34	<7750	0.0	0.0		
35	7750-8750	2.2	22.5		
36	>8750	0.0	0.0		
CRUISE .7-.8 VP	TOTAL	0.6	6.2		
37	<7750	0.0	0.0		
38	7750-8750	0.6	6.2		
39	>8750	0.0	0.0		
CRUISE .8-.9 VH	TOTAL	0.0	0.0		
40	<7750	0.0	0.0		
41	7750-8750	0.0	0.0		
42	>8750	0.0	0.0		
CRUISE .9-1.0 VH	TOTAL	0.0	0.0		
43	<7750	0.0	0.0		
44	7750-8750	0.0	0.0		
45	>8750	0.0	0.0		
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0		
46	<7750	0.0	0.0		
47	7750-8750	0.0	0.0		
48	>8750	0.0	0.0		
CRUISE >1.1 VH	TOTAL	0.0	0.0		
49	<7750	0.0	0.0		
50	7750-8750	0.0	0.0		
51	>8750	0.0	0.0		
CLIMB >.5 VH	TOTAL	0.0	0.0		
52	<7750	0.0	0.0		
53	7750-8750	0.0	0.0		
54	>8750	0.0	0.0		
DESCENT >.5 VH	TOTAL	0.4	3.7		
55	<7750	0.0	0.0		
56	7750-8750	0.4	3.7		
57	>8750	0.0	0.0		
ACCEL TO CLIMB	TOTAL	0.0	0.1		
58	<7750	0.0	0.0		
59	7750-8750	0.0	0.1		
60	>8750	0.0	0.0		

Figure 21. (Continued)

SIRS SPECTRUM USAGE

PAGE 3

AIRCRAFT: 74-22570, LOG TIME: 100.7 RETRIEVAL DATE: 20/1/82 REASON: SCHEDULE
 RECORDER: 1000 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 ***** INDICATES AN INVALID FLIGHT CONDITION VALUE

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE	
		RETRIVAL	PER 100 HOURS	RETRIVAL	PER 100 HOURS
FLARE	TOTAL			1.	10.
61	<7750			0.	0.
62	7750-8750			1.	10.
63	>8750			0.	0.
NZ PEAKS 1.1-1.5 G	TOTAL			1640.	10101.
64	<7750			0.	0.
65	7750-8750			1640.	10101.
66	>8750			0.	0.
NZ PEAKS 1.5-1.8 G	TOTAL			54.	101.
67	<7750			0.	0.
68	7750-8750			54.	101.
69	>8750			0.	0.
NZ PEAKS 1.8-2.0 G	TOTAL			13.	101.
70	<7750			0.	0.
71	7750-8750			13.	101.
72	>8750			0.	0.
NZ PEAKS >2.0 G	TOTAL			2.	10.
73	<7750			0.	0.
74	7750-8750			2.	10.
75	>8750			0.	0.
ROTOR CYCLE	TOTAL			78.	101.
244				78.	101.
NORMAL LANDING	TOTAL			65.	101.
245				65.	101.
AUTOLATIVE LADGE	TOTAL			49.	100.
246				49.	100.
FLIGHT TIME	TOTAL	9.0	100.0		
267	<7750	0.0	0.0		
268	7750-8750	0.0	100.0		
269	>8750	0.0	0.0		
GROUND TIME	TOTAL	2.0	24.0		
270		2.0	24.0		
NORMAL TURN 1.5 VR	TOTAL	0.0	0.0		
271	<7750	0.0	0.0		
272	7750-8750	0.0	0.0		
273	>8750	0.0	0.0		
NORMAL TURN 1.5-1.7 VR	TOTAL	0.0	0.0		
274	<7750	0.0	0.0		
275	7750-8750	0.0	0.0		
276	>8750	0.0	0.0		

Figure 21. (Continued)

SIRS SPECTRUM USAGE

PAGE 4

AIRCRAFT: 76-22570. LOG TIME: 054. RETRIEVAL DATE: 20/1/80 REASON: SCHEDULED
 RECORDER: 1207 BASE: 2
 DELTA LOG TIME: 12.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS #FLIGHT (LB)	TIME (HOURS)		OCCURRENCE	
		RETRIEVAL	PER 100 HOURS	RETRIEVAL	PER 100 HOURS
NORMAL TURN 1.7-1.9 VH	TOTAL	0.0	0.0		
277	<7750	0.0	0.0		
278	7750-8750	0.0	0.0		
279	>8750	0.0	0.0		
NORMAL TURN >1.9 VH	TOTAL	0.0	0.0		
280	<7750	0.0	0.0		
281	7750-8750	0.0	0.0		
282	>8750	0.0	0.0		
AUTO TURNS NZ<1.5 G	TOTAL	0.1	0.0		
283	7750	0.0	0.0		
284	7750-8750	0.1	0.0		
285	>8750	0.0	0.0		
AUTO TURNS NZ 1.5 G	TOTAL	0.0	0.0		
286	<7750	0.0	0.0		
287	7750-8750	0.0	0.0		
288	>8750	0.0	0.0		
AUTOROTATIVE TIME	TOTAL	0.7	0.0		
289	<7750	0.0	0.0		
290	7750-8750	0.7	0.0		
291	>8750	0.0	0.0		
SYMMETRICAL DIVE	TOTAL	0.0	0.0		
292	<7750	0.0	0.0		
293	7750-8750	0.0	0.0		
294	>8750	0.0	0.0		
ASYMMETRICAL DIVE	TOTAL	0.0	0.0		
295	<7750	0.0	0.0		
296	7750-8750	0.0	0.0		
297	>8750	0.0	0.0		
SYMMETRICAL PULLUP	TOTAL	0.0	0.0		
298	<7750	0.0	0.0		
299	7750-8750	0.0	0.0		
300	>8750	0.0	0.0		
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0		
301	<7750	0.0	0.0		
302	7750-8750	0.0	0.0		
303	>8750	0.0	0.0		

Figure 21. (Continued)

SIRS SPECTRUM USAGE

PAGE 5

AIRCRAFT: 76-22570. LOG TIME: 600.7 RETRIEVAL DATE: 20/ 0/00 RFA: ON: SCHEDULED
 RECORDED: 1007 BASE: 2
 DELTA LOG TIME: 12.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247	RPM PEAK VALUE	376.0
248	TORQUE PEAK VALUE	50.0
249	VL PEAK VALUE	0.6
250	VH PEAK VALUE	0.8
251	DENS ALT PPAK VALUF	3851.0
252	WZ PEAK VALUE	2.1
253	OAT MAXIMUM VALUE	17.5
254	OAT MINIMUM VALUE	19.0
255	GROSS WEIGHT PEAK	0.0
256	ROLL PEAK VALUE	59.7

DENSITY ALTITUDE HISTOGRAM
ALTITUDE (K FT)

	<1	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	0.2	2.2	5.6	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6
PER 100 HRS	1.7	22.4	58.5	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
FLT COND NRS	304	305	306	307	308	309	310	311	312	313	314	

RPM HISTOGRAM
RPM

	<314	314	319	324	329	334	339	TOTAL
RETRIEVAL	0.1	0.5	0.1	0.9	0.0	0.2	0.0	9.6
PER 100 HRS	1.0	5.7	83.6	9.7	0.0	0.0	0.0	100.0
FLT COND NRS	315	316	317	318	319	320	321	

TORQUE HISTOGRAM
TORQUE (PSI)

	<10	10	20	30	40	50	TOTAL
RETRIEVAL	0.7	0.9	3.1	4.5	0.4	0.0	9.6
PER 100 HRS	6.8	9.7	32.5	47.1	3.9	0.0	100.0
FLT COND NRS	322	323	324	325	326	327	

Figure 21. (Continued)

SIRS SPECTRUM USAGE

PAGE C

AIRCRAFT: 76-22570. LOG TIME: 600.7 RETRIEVAL DATE: 22/ 6/80 REASON: SCHEDULED
 RECORDER: 1007 BASE: 2
 DELTA LOG TIME: 12.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: <10%

A/S (VR)	<10	10	TORQUE (PSI) 20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5				0.0	0.0		0.0	76- 81
PER 100 HRS				0.0	0.0		0.0	
.5								82- 87
PER 100 HRS								
.7								88- 93
PER 100 HRS								
.9								94- 99
PER 100 HRS								
***TOTAL				0.0	0.0		0.0	
PER 100 HRS				0.0	0.0		0.0	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 10-20%

A/S (VR)	<10	10	TORQUE (PSI) 20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5				0.0	0.0		0.0	100-105
PER 100 HRS				0.0	0.2	0.0	0.3	
.5								106-111
PER 100 HRS								
.7								112-117
PER 100 HRS								
.9								118-123
PER 100 HRS								
***TOTAL				0.0	0.0	0.0	0.0	
PER 100 HRS				0.0	0.2	0.0	0.3	

Figure 21. (Continued)

SIRS SPECTRUM USAGE

PAGE 7

AIRCRAFT: 76-22570. LOG TIME: 660.7 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1007 BASE: 2
 DELTA LOG TIME: 12.4 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 20-40%

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.0	0.0	0.3	0.5	0.0		0.6	124-129
PER 100 HRS	0.0	0.0	3.2	5.4	0.1		8.7	
.5								130-135
PER 100 HRS								
.7								136-141
PER 100 HRS								
.9								142-147
PER 100 HRS								
***TOTAL	0.0	2.2	0.3	0.5	0.0		0.8	
PER 100 HRS	0.0	0.0	3.2	5.4	0.1		8.7	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 40-60%

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.0	2.1	0.6	2.5	0.0		1.1	148-153
PER 100 HRS	0.3	0.6	5.9	4.2	0.1		11.9	
.5		0.0	0.5	2.0	0.1		2.6	154-159
PER 100 HRS		0.2	4.7	27.4	1.3		26.6	
.7		0.0	0.0	0.4	0.2		0.6	160-165
PER 100 HRS		0.0	0.1	4.6	1.7		6.4	
.9								166-171
PER 100 HRS								
***TOTAL	0.0	0.1	1.0	2.9	0.3		4.3	
PER 100 HRS	0.3	1.1	10.7	29.7	3.1		44.9	

Figure 21. (Continued)

SIRS SPECTRUM USAGE

PAGE 8

AIRCRAFT: 76-22570. LOG TIME: 680.7 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1007 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 60-80%

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.5	0.5	0.6	0.1	0.0		1.7	172-177
PER 100 HRS	5.4	5.0	5.9	1.5	0.0		17.6	
.5	0.1	0.3	1.2	0.9	0.0		2.5	178-187
PER 100 HRS	0.6	3.4	12.5	9.1	0.3		25.9	
.7	0.0	0.0	0.0	0.1	0.0		0.2	184-189
PER 100 HRS	0.0	0.0	0.2	1.2	0.4		1.7	
.9								190-195
PER 100 HRS								
***TOTAL	0.6	0.8	1.8	1.1	0.1		4.4	
PER 100 HRS	6.0	8.4	16.5	11.6	0.7		45.4	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 80-90%

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.0	0.0	0.0				0.1	196-201
PER 100 HRS	0.5	0.2	0.0				0.7	
.5	0.0		0.0				0.0	202-207
PER 100 HRS	0.0		0.0				2.0	
.7								208-213
PER 100 HRS								
.9								214-219
PER 100 HRS								
***TOTAL	0.0	0.0	0.0				0.1	
PER 100 HRS	0.5	0.2	0.1				0.7	

Figure 21. (Continued)

SIRS SPECTRUM USAGE

PAGE 9

AIRCRAFT: 76-22570. LOG TIME: 600.7 RETRIEVAL DATE: 20/ 6/00 REASON: SCHEDULED
 RECORDER: 1007 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION							
RUDDER POSITION: >90%							
A/S (VH)	<10	10	TORQUE (PSI)			TOTAL	FLIGHT CONDITIONS
			20	30	40	50	
<.5	0.0	0.0					0.0 220-225
PER 100 HRS	0.0	0.0					0.0
.5							226-231
PER 100 HRS							
.7							232-237
PER 100 HRS							
.9							238-243
PER 100 HRS							
***TOTAL	0.0	0.0					0.0
PER 100 HRS	0.0	0.0					0.0

Figure 21. (Concluded)

RECOMMENDATIONS

As a result of the flight testing conducted with the SIRS recorder system, several improvements are recommended to achieve IOT&E status. These improvements comprise items that will enhance recorder system performance and, therefore, the test data. The flight test data collected during this contract could be used to develop and test a fatigue damage assessment program that has been developed initially for the AH-1G helicopter and could be modified to include the flight condition categories and pertinent fatigue damage coefficients for the AH-1S aircraft.

1. Development of Fatigue Damage Assessment Program

The primary function of the SIRS software system in processing the SIRS recorder data is to compute the incremental fatigue damage to selected helicopter components.

This system consists of two discrete but complementary subsystems: the initial processing system (IPS) and the fatigue damage assessment system (FDAS). The basic function of the IPS is to process the recorded data for subsequent application in the component damage equation. The basic function of FDAS is to compute the incremental fatigue damage for the selected helicopter components.

The existing FDAS software has been written for the AH-1G helicopter. Different flight condition categories and component damage coefficients for the AH-1S helicopters require a modified FDAS software program based on manufacturers' fatigue and flight condition category data.

The AH-1S FDAS software should be established and debugged and the flight test data collected under this contract should be processed for an evaluation of cumulative fatigue damage based on recorded and logbook data.

2. Development of Gross Weight Measuring System

The gross weight measuring system developed under a previous contract used an instrumented lift link as a weight-sensing device. Theoretically, during hover conditions the lift-link sensor system will produce an output that is an analog of gross weight, assuming that aerodynamic influences such as those caused by the jet exhaust remain negligible. During horizontal flight at nominal air speeds, fuselage lift must be taken into consideration to determine gross weight.

Previous efforts with the lift-link sensor system were not successful due to difficulties encountered with the attachment of the sensing element to the link structure. It is likely that with modifications this attachment problem can be solved. In order to ensure reliable long-term operation, it is highly desirable to laboratory-test a lift link with the sensor attached under static and dynamic load conditions. Such a test program will assure sufficient fatigue endurance of the measuring element and attachment components. After successful completion of laboratory tests, installation of the link on an AH-1S helicopter is proposed for flight test evaluation.

3. Long-Term Accuracy of Takeoff and Landing Detection

The landing and takeoff detection method developed during this program could not be thoroughly evaluated because of the short time remaining on the contract and the

non-interference aspects of the mission requirements for the helicopters at Fort Rucker. The distribution of the recorded flight time versus recorded ground time appears reasonable when compared with accrued logbook hours; however, a controlled testing and evaluation of the number of normal/autorotative landings recorded is necessary.

In order to properly evaluate the performance of the detection scheme, a short flight test program should be conducted in which an oscillograph recorder is installed in parallel with the SIRS recorder on one AH-1S aircraft. For the most efficient utilization of the test helicopter, the takeoff and landing evaluation could be conducted simultaneously with the flight test portion of the gross weight measurement effort described above.

4. Improved Service Life of Nonvolatile Memory

With the addition of more nonvolatile data memory for the AH-1S program, extended operational experience revealed that the service lives of the lithium batteries used for memory backup were approximately half of the expected 1-year period. Testing indicated that the vast majority of the power drain from the batteries is actually caused by support chips tied to the power source rather than the memory chips themselves. It is felt that this deficiency can be overcome by modifying the circuit; however, at this point it would be prudent to investigate the latest available technology in nonvolatile memory devices that do not require battery backup and then make a cost/benefit tradeoff comparison between the two approaches.

5. Improvements in System Reliability and Cost

The calibration of onboard sensors is a frequent requirement that cannot presently be performed on an independent, non-interference basis. A modification to the recorder system that may correct this problem and result in improved operating efficiency should be investigated. Also, the replacement of the n_z accelerometer with a hermetically sealed unit is required and possible replacement of the other transducers with less costly devices should be investigated.

The reliability of the data retrieval unit under high ambient temperature conditions can be further improved by utilization of components manufactured according to military specifications.

ABBREVIATIONS

ACIA	Asynchronous Communications Interface Adapter
A/S	Airspeed
CMOS	Complementary Metal Oxide Silicon
EIA	Electronic Industry Association
EPROM	Erasable Programmable Read-Only Memory
FCC	Flight Condition Category
FCM	Flight Condition Monitoring
FDAS	Fatigue Damage Assessment System
GW	Gross Weight
H-GW	High Gross Weight
IOT&E	Initial Operational Test and Evaluation
IPS	Initial Processing System
L-GW	Light Gross Weight
M-GW	Medium Gross Weight
N_z	Acceleration in Vertical Direction
OAT	Outside Air Temperature
PC	Printed Circuit
PIA	Parallel Interface Adapter
RAM	Random Access Memory
SIRS	Structural Integrity Recording System
TQ	Torque
TTL	Transistor-Transistor Logic
V_H	Maximum Attainable (Level Flight) Velocity - Airspeed
V_L	Limit Velocity

APPENDIX A SIRS RECORDER SOFTWARE

PAGE 001 GNDRS2 BASE SECTION FOR AH1S VERSION 2 11/4/78

00001	NAM	GNDRS2
00002	YTL	BASE SECTION FOR AH1S VERSION 2 11/
00003	OPT	REL

00005	*****
00006	* BASE SECTION TO BE *
00007	* CLEARED ON GROUND *
00008	*****

00010	XDEF	ZERO,T23A,MODE,TQHI,TQLO
00011	XDEF	M,GTS,NZE,NZHI,NZLO,SVH
00012	XDEF	SVL,SGW,T86,QMOD
00013	XDEF	T23

00015B 0000		BSCT
00016B 0000	0001 A	RMB 1
00017B 0001	0002 A ZERO	RMB 2
00018B 0003	0003 A T23A	RMB 3
00019B 0006	0001 A GTS	RMB 1
00020B 0007	0001 A MODE	RMB 1
00021B 0008	0001 A TQHI	RMB 1
00022B 0009	0001 A TQLO	RMB 1
00023B 000A	0001 A M	RMB 1
00024B 000B	0001 A NZE	RMB 1
00025B 000C	0001 A NZHI	RMB 1
00026B 000D	0001 A NZLO	RMB 1
00027B 000E	0001 A SVH	RMB 1
00028B 000F	0001 A SVL	RMB 1
00029B 0010	0001 A SGW	RMB 1
00030B 0011	0002 A T86	RMB 2
00031B 0013	0001 A QMOD	RMB 1
00032B 0014	0003 A T23	RMB 3

8
F

PAGE 002 GNDHS2 BASE SECTION FOR AHIS VERSION 2 11/4/78

00034 *****
 00035 * INTERMODULE BASE SECTION *
 00036 *****

00038 XDEF CNZ,CHD,CVL,CVH,CQ,CROL
 00039 XDEF CRFM,CGW,CT,CRD,CRUD
 00040 XDEF DALT,CNVTAB,KNOTS,ALTFT
 00041 XDEF SHFTCT,VLDLY,NUM,MSNDX,ACOFF
 00042 XDEF FWONTM,CNT,TNDVFG,DUTABL
 00043 XDEF EXPTR,FTIME,FTIME2,EXFLG

00045B 0017	0001	A CNZ	RMB	1	VERT ACCEL
00046B 0018	0001	A CHD	RMB	1	DENSITY ALT
00047B 0019	0001	A CVL	RMB	1	A/S @ VL
00048B 001A	0001	A CVH	RMB	1	A/S @ VH
00049B 001B	0001	A CQ	RMB	1	% ENGINE TORQUE
00050B 001C	0001	A CROL	RMB	1	ROLL ATTITUDE
00051B 001D	0001	A CRFM	RMB	1	ROTOR SPEED
00052B 001E	0001	A CGW	RMB	1	GROSS WEIGHT
00053B 001F	0001	A CT	RMB	1	AIR/GROUND
00054B 0020	0001	A CRD	RMB	1	LEVEL,CLIMB,DIVE
00055B 0021	0001	A CRUD	RMB	1	% RUDDER POSITION
00057B 0022	0001	A DALT	RMB	1	DENSITY ALT
00058B 0023	0010	A CNVTAB	RMB	16	A/D CONVERSIONS
00059B 0033	0001	A KNOTS	RMB	1	A/S IN KNOTS
00060B 0034	0001	A ALTFT	RMB	1	ALT 12 CNTS PER 1000 FEET
00061B 0035	0001	A SHFTCT	RMB	1	* SHIFTS AFTER MPY
00062B 0036	0001	A NUM	RMB	1	NUMERATOR FOR DIVIDE
00063B 0037	0002	A MSNDX	RMB	2	SAVE X
00064B 0039	0001	A ACOFF	RMB	1	AC POWER OFF
00065B 003A	0001	A FWONTM	RMB	1	RECORDER ON TIME
00066B 003B	0001	A CNT	RMB	1	MISC
00067B 003C	0001	A TNDVFG	RMB	1	TURN/DIVE FLAG
00068B 003D	004B	A DUTABL	RMB	75	TABLE FOR CLIMB/DIVE
00069B 0088	0001	A VLDLY	RMB	1	FOR POWER ON 12.8 SEC DELA
00071B 0089	0002	A EXPTR	RMB	2	PTR FOR PER FLT DATA
00072B 008B	0001	A FTIME	RMB	1	TIME PER FLIGHT
00073B 008C	0002	A FTIME2	RMB	2	
00074B 008E	0001	A EXFLG	RMB	1	

B
B

PAGE 003 GND852 BASE SECTION FOR AHIS VERSION 2 11/4/78

00076	*CNZ	0	<.8	CRD	-1	NOT VALID
00077	*	1	.8-1.1		0	LEVEL
00078	*	2	1.1-1.3		1	DESCENT
00079	*	3	1.3-1.5		2	CLIMB
00080	*	4	1.5-1.7			
00081	*	5	>1.7	CRUD	0	0-10
00082	*				1	10-20
00083	*CHD	-2	<2K		2	20-40
00084	*	-1	2K-4K		3	40-60
00085	*	0	4K-6K		4	60-80
00086	*	1	6K-9K		5	80-90
00087	*	2	9K		6	90%
00089	*CVH	-2	<.3			
00090	*	-1	.3-.5			
00091	*	0	.5-.6			
00092	*	1	.6-.7			
00093	*	2	.7-.8			
00094	*	3	.8-.9			
00095	*	4	.9-1.0			
00096	*	5	1.0-1.1			
00097	*	6	>1.1			
00099	*CVL	-1	<.7			
00100	*	0	.7-.85			
00101	*	1	.85-.95			
00102	*	2	>.95			
00104	*CRUL	-1	<10			
00105	*	0	10-25			
00106	*	1	25-35			
00107	*	2	>35			
00109	*CQ	-1	<10			
00110	*	0	10-20			
00111	*	1	20-30			
00112	*	2	30-40			
00113	*	3	40-50			
00114	*	4	>50			
00116	*CRPM	-4	<250			
00117	*	-3	250-314			
00118	*	-2	314-319			
00119	*	-1	319-324			
00120	*	0	324-329			
00121	*	1	329-334			
00122	*	2	334-339			
00123	*	3	>339			
00125	*CGW	0	<7750			
00126	*	1	7750-8750			
00127	*	2	>8750			
00129	*CT	0	AIR			
00130	*	1	GROUND			
00131			END			
TOTAL ERRORS 00000						

AD-AU98 236

TECHNOLOGY INC DAYTON OHIO

F/G 14/3

STRUCTURAL INTEGRITY RECORDING SYSTEM (SIRS) FOR U.S. ARMY AH-1--ETC(U)

MAR 81 J G DOTSON, A W KOLB

DAAJ02-77-C-0079

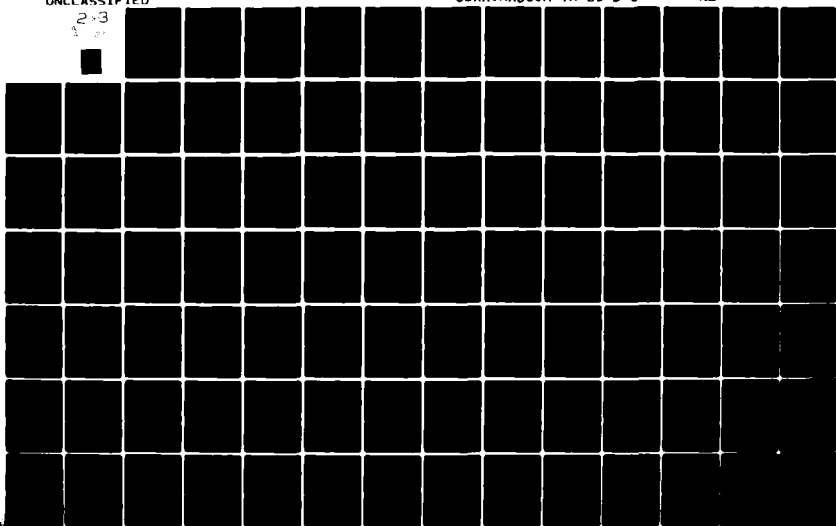
UNCLASSIFIED

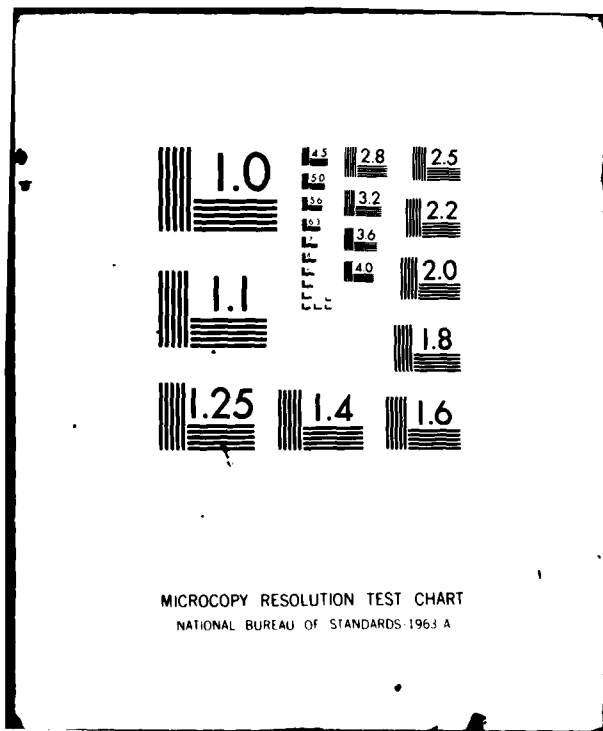
USAAVRADCOM-TR-81-D-6

NL

23

23





PAGE 001 FCCLST

00001		NAM	FCCLST	
00002		OPT	REL	
00003		XDEF	ASSLP,ASINT,ALTSLP,ALTINT	
00004		XDEF	NZSLP,NZINT,TQSLP,TQINT,RUDINT	
00005		XDEF	RUDSLP,GWSLP,GWINT,GROSWT,ARM	
00006		XDEF	FCGNTN,FCGSTN,FCHVR,FCCRZ	
00007		XDEF	FCCLMB,FCDSNT,FCACCM,FCFLAR	
00008		XDEF	FCNZPK,FCTVR,FRCRPM,FCTOLD	
00009		XDEF	FCAULD,FCRPM,FCTQPK,FCVLPK	
00010		XDEF	FCVHPK,FCDAK,FCPKNZ,FCOATH	
00011		XDEF	FCOATL,FCGWP,FCRLPK	
00012		XDEF	FCGWS,FCGNTN,FCNRTN,FCAUTH	
00013		XDEF	FCAUTN,FCDAHS,FCRPMH,FCTQHS	
00014		XDEF	FCASDV,FCASPU,FCSDV,FCSPU	
00015	0400	A H4	EQU	\$400
00017	0400	A FCGNTN	EQU	04H4 GUNNERY TURN A/S <.5 VH
00018		*		6 " A/S .5-.7 VH
00019		*		12 " A/S .7-.9 VH
00020		*		18 " A/S >.9 VH
00021	0418	A FCGSTN	EQU	24+H4 GUN S TURN A/S <.5 VH
00022		*		30 " A/S .5-.7 VH
00023		*		36 " A/S .7-.9 VH
00024		*		42 " A/S >.9 VH
00025	0430	A FCHVR	EQU	48+H4 HOVER A/S <.3 VH
00026	0436	A FCCRZ	EQU	54+H4 CRUISE A/S .3-.5 VH
00027		*		60 " A/S .5-.6 VH
00028		*		66 " A/S .6-.7 VH
00029		*		72 " A/S .7-.8 VH
00030		*		78 " A/S .8-.9 VH
00031		*		84 " A/S .9-1.0 VH
00032		*		90 " A/S 1.0-1.1 VH
00033		*		96 " A/S >1.1 VH
00034	0466	A FCCLMB	EQU	102+H4 CLIMB A/S >.5 VH
00035	046C	A FCDSNT	EQU	108+H4 DESCENT A/S >.5 VH
00036	0472	A FCACCM	EQU	114+H4 ACCELERATION TO CLIMB
00037	0478	A FCFLAR	EQU	120+H4 FLARE
00038	047E	A FCNZPK	EQU	126+H4 NZ PEAKS 1.1-1.3 G'S
00039		*		132 " 1.3-1.5 G'S
00040		*		138 " 1.5-1.7 G'S
00041		*		144 " >1.7 G'S
00042	0496	A FCTVR	EQU	150+H4 TRI-VARIANT TABLE
00043	05E6	A FRCRPM	EQU	486+H4 ROTOR CYCLES
00044	05E8	A FCTOLD	EQU	488+H4 LANDINGS
00045	05EA	A FCAULD	EQU	490+H4 AUTO-ROTATIVE LANDINGS
00047	05EC	A FRCRPM	EQU	492+H4 RPM PEAK VALUE
00048	05ED	A FCTQPK	EQU	493+H4 TORQUE PEAK VALUE
00049	05EE	A FCVLPK	EQU	494+H4 VL PEAK VALUE
00050	05EF	A FCVHPK	EQU	495+H4 VH PEAK VALUE
00051	05F0	A FCDAPK	EQU	496+H4 DENSITY ALTITUDE PEAK
00052	05F1	A FCPKNZ	EQU	497+H4 VERTICAL ACCEL PEAK
00053	05F2	A FCOATH	EQU	498+H4 OAT MAXIMUM VALUE
00054	05F3	A FCOATL	EQU	499+H4 OAT MINIMUM VALUE
00055	05F4	A FCGWP	EQU	500+H4 GROSS WEIGHT PEAK VALUE
00056	05F5	A FCRLPK	EQU	501+H4 ROLL PEAK READING
00057	05F6	A GROSWT	EQU	502+H4 GROSS WEIGHT STORAGE
00058	05F7	A ARM	EQU	503+H4 ROTOR CYCLE ARM

PAGE 002 FCCLST

00060	0600	A H6	EQU	\$600	
00062	0600	A FCGWHS	EQU	0+H6	GROSS WEIGHT HISTOGRAM
00063	0609	A FCGNTH	EQU	9+H6	GROUND TIME
00064	060C	A FCNRTN	EQU	12+H6	NORMAL TURNS A/S <.5 VH
00065		*		21+H6	" " A/S .5-.7 VH
00066		*		30+H6	" " A/S .7-.9 VH
00067		*		39+H6	" " A/S >.9 VH
00068	0630	A FCAUTN	EQU	48+H6	AUTOROTATIVE TURNS NZ<1.5
00069		*		57+H6	" " NZ>1.5
00070	0642	A FCAUTH	EQU	66+H6	AUTOROTATIVE TIME
00071	064B	A FCSMDV	EQU	75+H6	SYMMETRICAL DIVE
00072	0654	A FCASDV	EQU	84+H6	ASYMMETRICAL DIVE
00073	065D	A FCSMPU	EQU	93+H6	SYMMETRICAL PULLUP
00074	0666	A FCASPU	EQU	102+H6	ASYMMETRICAL PULLUP
00075	066F	A FCDAHS	EQU	111+H6	DENSITY ALT HISTOGRAM <1K
00076		*		114+H6	" " " 1K-2K
00077		*		117+H6	" " " 2K-3K
00078		*		120+H6	" " " 3K-4K
00079		*		123+H6	" " " 4K-5K
00080		*		126+H6	" " " 5K-6K
00081		*		129+H6	" " " 6K-7K
00082		*		132+H6	" " " 7K-8K
00083		*		135+H6	" " " 8K-9K
00084		*		138+H6	" " " 9K-10
00085		*		141+H6	" " " >10K
00086	0690	A FCRPMH	EQU	144+H6	RPM HISTOGRAM <314
00087		*		147+H6	" " " 314-319
00088		*		150+H6	" " " 319-324
00089		*		153+H6	" " " 324-329
00090		*		156+H6	" " " 329-334
00091		*		159+H6	" " " 334-339
00092		*		162+H6	" " " >339
00093	06A5	A FCTQHS	EQU	165+H6	TORQUE HISTOGRAM <10 PSI
00094		*		168+H6	" " " 10-20 PSI
00095		*		171+H6	" " " 20-30 PSI
00096		*		174+H6	" " " 30-40 PSI
00097		*		177+H6	" " " 40-50 PSI
00098		*		180+H6	" " " >50 PSI
00100	06B7	A NZINT	EQU	183+H6	NZ INTERCEPT
00101	06B8	A NZSLP	EQU	184+H6	NZ SLOPE
00102	06B9	A ALTINT	EQU	185+H6	ALTITUDE INTERCEPT
00103	06BA	A ALTSLP	EQU	186+H6	ALTITUDE SLOPE
00104	06BB	A ASINT	EQU	187+H6	AIRSPED INTERCEPT
00105	06BC	A ASSLP	EQU	188+H6	AIRSPED SLOPE
00106	06BD	A GWINT	EQU	189+H6	GROSS WEIGHT INTERCEPT
00107	06BE	A GWSLP	EQU	190+H6	GROSS WEIGHT SLOPE
00108	06BF	A TQINT	EQU	191+H6	TORQUE INTERCEPT
00109	06C0	A TQSLP	EQU	192+H6	TORQUE SLOPE
00110	06C1	A RUDINT	EQU	193+H6	RUDDER INTERCEPT
00111	06C2	A RUDSLP	EQU	194+H6	RUDDER SLOPE
00112			END		
TOTAL ERRORS 00000					

PAGE 001 BADMP A/D CONVERSION, ETC. AH15 11/4/78

```

00001      NAM      BADMP
00002      OPT      NOG,REL,CREF
00003      TTL      A/D CONVERSION, ETC. AH15 11/4/78
00004      XDEF     ACIACS,ACIAXR,STACK
00005      XDEF     MUX,MUXCR,ADCNV
00006      XDEF     RESTRT,TENHZ,NZTABL,XCER,LINEAR
00007      XDEF     MPY8,MPY7,MPY5,SHIFT

00009      XREF     PSCT:ASTABL,ALTABL
00010      XREF     ANY:NZINT,NZSLP,ASINT,ASSLP
00011      XREF     ANY:ALTSLP,ALTINT,FCDA PK
00012      XREF     ANY:FCDATH,FCDATL
00013      XREF     BSCT:CNZ,CHD,DALT,CNVTAB,KNOTS,CT
00014      XREF     BSCT:VLDLY,ALTFT,SHFTCT,NUM,MSNDX

00016      00FF A STACK EQU $FF
00017      1000 A ACIACS EQU $1000 CONTROL/STATUS REGISTER
00018      1001 A ACIAXR EQU $1001 TRANSMIT/RECEIVE REG
00019      2000 A AD EQU $2000 A/D INPUT REG
00020      2001 A ADCR EQU $2001 A/D CONTROL REG
00021      2002 A MUX EQU $2002 MUX OUTPUT REG
00022      2003 A MUXCR EQU $2003 MUX CONTROL REG
00023      009D A ACIACW EQU X10011101 CONTROL WORD
00024      0034 A ADCW EQU X00110100
00025      0004 A MUXCW EQU X00000100
00026      003C A ADSTRT EQU X00111100 A/D START WORD
00027      001F A MUXIO EQU $1F PB0-PB4 ARE ONLY OUTPUTS

00029      0054 A PT33 EQU 84 84/256 = 0.328
00030      00AE A PT68 EQU 174 174/256 = 0.680
00031      00BF A PT75 EQU 191 191/256 = 0.746

00032B 0000      BSCT
00033B 0000      0002 A SAVADR RMB 2
00034B 0002      0002 A SAVCV RMB 2
00035B 0004      0001 A RNDOFF RMB 1

00037      *-----*
00038      *NZ <.8 .8-1.1 1.1-1.3 1.3-1.5 1.5-1.7 >1.7
00039      *CNZ 0 1 2 3 4 5
00040      *-----*

00042      *-----*
00043      *DALT <2K 2K-4K 4K-6K 6K-9K >9K
00044      *CHD -2 -1 0 1 2
00045      *-----*

00047      *****
00048      * POWER UP RESET *
00049      * A/D CONVERSIONS PER ADRTAB *
00050      * CORRECT NZ, SET CNZ *
00051      * CALCULATE TEMP C & F FOR RTU DISPLAY *
00052      * CORRECT A/S, CNVT TO KNOTS, STORE AT KNOTS *
00053      * CORRECT ALT, CNVT TO FEET, STORE AT ALTFT *
00054      * CALCULATE DENSITY ALT, SET CHD, PEAK DALT *
00055      * XCER, LINEAR, MPY & SHIFT SUBROUTINES *
00056      *****

```

```

00058P 0000                                PSCT

00060P 0000    0F    A ADRTAB FCB    15    ( 0)RPM
00061P 0001    08    A        FCB     8    ( 1)ROLL ATTITUDE
00062P 0002    02    A        FCB     2    ( 2)ROLL REFERENCE
00063P 0003    01    A        FCB     1    ( 3)RUDDER
00064P 0004    09    A        FCB     9    ( 4)TORQUE 1
00065P 0005    0B    A        FCB    11    ( 5)TORQUE REFERENCE
00066P 0006    03    A        FCB     3    ( 6)VERTICAL ACCEL. (NZ)
00067P 0007    04    A        FCB     4    ( 7)ALTITUDE
00068P 0008    07    A        FCB     7    ( 8)AIRSPEED
00069P 0009    0A    A        FCB    10    ( 9)OUTSIDE AIR TEMP. (OAT
00070P 000A    06    A        FCB     6    (10)AMPLIFIED ROLL
00071P 000B    05    A        FCB     5    (11)BATTERY VOLTAGE
00072P 000C    0C    A        FCB    12    (12)RECORDER S/N LO
00073P 000D    0E    A        FCB    14    (13)RECORDER S/N HIGH
00074P 000E    06    A        FCB     6    (14)SPARE 1
00075P 000F    0D    A        FCB    13    (15)SPARE 2

00077P 0010  BE 00FF  A RESTRT LDS    #STACK  SET UP STACK
00078P 0013  86 1F    A        LDAA  #MUXIO  PB0 - PB4 OUTPUTS
00079P 0015  B7 2002  A        STAA  MUX     FOR MUX ADDRESS
00080P 0018  86 34    A        LDAA  #ADCW   CA2 IS OUTPUT
00081P 001A  B7 2001  A        STAA  ADCR
00082P 001D  86 04    A        LDAA  #MUXCW
00083P 001F  B7 2003  A        STAA  MUXCR
00084P 0022  86 03    A        LDAA  #3      ACIA RESET
00085P 0024  B7 1000  A        STAA  ACIACS
00086P 0027  86 9D    A        LDAA  #ACIACW
00087P 0029  B7 1000  A        STAA  ACIACS
00088P 002C  30      TSX
00089P 002D  09      DEX

00091P 002E  6F 00    A CLRMOR CLR    0,X    *****
00092P 0030  09      DEX                *CLEAR SCRATCHPAD MEMORY*
00093P 0031  26 FB 002E BNE    CLRMOR *****
00094P 0033  86 10    A        LDAA  #16    SET PEAK RPM
00095P 0035  B7 2002  A        STAA  MUX     FLIP FLOPP
00096P 0038  0E      CLI                ENABLE RTU INTERRUPT
00097P 0039  C6 64    A        LDAB  #100   DELAY FOR 10 SECONDS
00098P 003B  86 2003  A XX      LDAA  MUXCR  TO ALLOW FOR CHANNELS
00099P 003E  2A FB 003B BPL    XX          TO STABILIZE
00100P 0040  86 2002  A        LDAA  MUX
00101P 0043  5A      DECB
00102P 0044  26 F5 003B BNE    XX
00103P 0046  7C 0000  A        INC    CT     PRESET TO GROUND

00105P 0049  0E      TENHZ  CLI          ENABLE INTERRUPT
00106P 004A  8D 03 004F BSR    ADCNVT
00107P 004C  7E 0177  P        JMP    SETCHD

```


PAGE 003 BADMP A/D CONVERSION, ETC. AH1S 11/4/78

```

00109 *****
00110 *MAKE A/D CONVERSIONS *
00111 *STORE RESULTS IN *
00112 *CONVERSION TABLE *
00113 *****
00114 * SUBROUTINE *
00115 *****

```

```

00118P 004F 86 0E A ADCNVT LDAA #14 NMB OF CONVERSIONS

00120P 0051 CE 0000 P LDX #ADRTAB MUX ADDRESS TABLE
00121P 0054 DF 00 B STX SAVADR
00122P 0056 CE 0000 A LDX #CNVTAB TABLE FOR RESULTS
00123P 0059 DF 02 B STX SAVCNV
00124P 005B DE 00 B REPEAT LDX SAVADR GET MUX ADDRESS
00125P 005D E6 00 A LDAB 0,X
00126P 005F F7 2002 A STAB MUX SEND MUX ADDRESS
00127P 0062 C6 C8 A LDAB #200
00128P 0064 09 DELAY DEX *****
00129P 0065 08 INX *DELAY FOR MUX*
00130P 0066 5A DECB * TO SETTLE *
00131P 0067 26 FB 0064 BNE DELAY *****
00132P 0069 F6 2000 A LDAB AD CLEAR A/D DONE
00133P 006C C6 3C A LDAB #ADSTRT *****
00134P 006E F7 2001 A STAB ADCR * START CONVERSION *
00135P 0071 C6 34 A LDAB #ADCW *READY FOR NEXT TIME*
00136P 0073 F7 2001 A STAB ADCR *****
00137P 0076 7C 0001 B INC SAVADR+1 PREPARE FOR NEXT ADDRESS
00138P 0079 DE 02 B LDX SAVCNV
00139P 007B F6 2001 A ENDCVT LDAB ADCR
00140P 007E 2A FB 007B BPL ENDCVT WAIT FOR END OF CONVERSION
00141P 0080 F6 2000 A LDAB AD GET CONVERSION
00142P 0083 E7 00 A STAB 0,X STORE IN CONVERSION TABLE
00143P 0085 7C 0003 B INC SAVCNV+1 PREPARE FOR NEXT CONVERSI
00144P 0088 4A DECA CHECK FOR LAST CONVERSION
00145P 0089 26 D0 005B BNE REPEAT

```

```

00147 *****
00148 * CORRECT NZ *
00149 *****

```

```

00151P 008B B6 0000 A LDAA NZINT INTERCEPT CORRECTION
00152P 008E D6 06 A LDAB CNVTAB+6 NZ CONVERSION
00153P 0090 53 COMB FOR -3 TO +1 ACCEL
00154P 0091 97 00 A STAA NUM STORE INTERCEPT FOR XCER
00155P 0093 B6 0000 A LDAA NZSLP SLOPE CORRECTION
00156P 0096 BD 0123 P JSR XCER
00157P 0099 97 06 A STAA CNVTAB+6 RETURN CORRECTED NZ

```

PAGE 004 BADMP A/D CONVERSION, ETC. AHIS 11/4/78

```

00159 *****
00160 *   SET C   FLAG   *
00161 *****

00163P 009B C6 05   A       LDAB   #5
00164P 009D D7 00   A       STAB   CNZ
00165P 009F CE 00AC P       LDX    #NZTABL
00166P 00A2 A1 00   A LOOP   CMPA   0,X      (1.7 1.5 1.3 1.1 0.8 OR 0)
00167P 00A4 24 0C 00B2     BCC    DATL      BR IF NZ > TABLE VALUE
00168P 00A6 7A 0000 A       DEC    CNZ
00169P 00A9 08           INX
00170P 00AA 20 F6 00A2     BRA     LOOP

00172P 00AC      AC      A NZTABL FCB   172,159,147,134,115,0
00173      *                               FOR -3 TO +1 ACCEL

00175 *****
00176 *   TEMPERATURE PEAKS   *
00177 *****

00179P 00B2 96 00   A DATL   LDAA    VLDLY   12.8 SEC DELAY OVER ?
00180P 00B4 2A 14 00CA     BPL     CALTM1  NO, SKIP PEAKS
00181P 00B6 96 09   A       LDAA    CNVTAB+9 TEMPERATURE CONVERSION
00182P 00BB B1 0000 A       CMPA    FCOATL  PRESENT OAT > PEAK ?
00183P 00BB 25 03 00C0     BCS     OATH    NO,BR
00184P 00BD B7 0000 A       STAA    FCOATL

00186P 00C0 40           DATH   NEGA
00187P 00C1 B1 0000 A       CMPA    FCOATH  PRESENT OAT < MIN PEAK ?
00188P 00C4 25 03 00C9     BCS     CALTM   NO,BR
00189P 00C6 B7 0000 A       STAA    FCOATH

00191 *****
00192 *   CALCULATE TEMPERATURE   *
00193 *   IN CENTIGRADE FOR RTU   *
00194 *****

00196P 00C9 43           CALTM  COMA
00197P 00CA 81 8C   A CALTM1 CMPA    #140    0 DEG POINT
00198P 00CC 25 07 00D5     BCS     PLUST    BRA IF + DEG C
00199P 00CE 80 8C   A       SUBA    #140
00200P 00D0 44           LSRA
00201P 00D1 8B 64   A       ADDA    #100    DIVIDE BY 2
00202P 00D3 20 04 00D9     BRA     THANS    THE '1' INDICATES MINUS
00203P 00D5 43           PLUST  COMA
00204P 00D6 80 73   A       SUBA    #115
00205P 00D8 44           LSRA
00206P 00D9 97 0E   A THANS  STAA    CNVTAB+14 STORE RESULT

```

PAGE 005 BADMF A/D CONVERSION, ETC. AH1S 11/4/78

```

00208 *****
00209 *   CALCULATE TEMPERATURE   *
00210 *   IN DEGREES F FOR RTU    *
00211 *****
00212P 00DB 96 09   A   LDAA   CNVTAB+9 TEMPERATURE
00213P 00DD 81 AF   A   CMPA   #175
00214P 00DF 23 0B 00EC   BLS   PLUSTF   BR IF > 0 DEG F
00215P 00E1 80 AF   A   SUBA   #175
00216P 00E3 C6 73   A   LDAB   #115
00217P 00E5 BD 01A2 P   JSR   MPY7
00218P 00E8 CB 64   A   ADDB   #100   TO INDICATE MINUS
00219P 00EA 20 0B 00F4   BRA   GO1
00220P 00EC 43   PLUSTF COMA
00221P 00ED 80 50   A   SUBA   #80
00222P 00EF C6 73   A   LDAB   #115
00223P 00F1 BD 01A2 P   JSR   MPY7
00224P 00F4 D7 0F   A   GO1   STAB   CNVTAB+15

00226 *****
00227 *   CORRECT DIFFERENTIAL PRESSURE   *
00228 *****
00229P 00F6 B6 0000 A   ASCOR LDAA   ASINT   INTERCEPT CORRECTION
00230P 00F9 D6 0B   A   LDAB   CNVTAB+8 DIFF PRESSURE CONVERSION
00231P 00FB 97 00   A   STAA   NUM     STORE INT FOR XCER
00232P 00FD B6 0000 A   LDAA   ASSLP   SLOPE CORRECTION
00233P 0100 8D 21 0123   BSR   XCER
00234P 0102 97 0B   A   STAA   CNVTAB+8 RETURN CORRECTED DIFF PRES

00236 *****
00237 *   CONVERT TO KNOTS   *
00238 *STORE RESULTS AT "KNOTS"*
00239 *****
00240P 0104 CE 0000 A   LDX   #ASTABL
00241P 0107 8D 30 0139   BSR   LINEAR
00242P 0109 D7 00   A   STAB   KNOTS

00244 *****
00245 *   CORRECT ABSOLUTE PRESSURE   *
00246 *****

00248P 010B B6 0000 A   LDAA   ALTINT   INTERCEPT CORRECTION
00249P 010E 97 00   A   STAA   NUM     STORE FOR XCER
00250P 0110 D6 07   A   LDAB   CNVTAB+7 PRESSURE CONVERSION
00251P 0112 53   COMB
00252P 0113 B6 0000 A   LDAA   ALTSLP   SLOPE CORRECTION
00253P 0116 8D 0B 0123   BSR   XCER
00254P 0118 97 07   A   STAA   CNVTAB+7 RETURN CORRECTED VALUE

00256 *****
00257 *CONVERT TO FEET   *
00258 *12 COUNTS = 1000 FT*
00259 *****

00261P 011A CE 0000 A   LDX   #ALTABL
00262P 011D 8D 1A 0139   BSR   LINEAR
00263P 011F D7 00   A   STAB   ALTFT
00264P 0121 20 2B 014B   BRA   DALTI

```

PAGE 006 BADMF A/D CONVERSION, ETC. AH1S 11/4/78

```

00266 *****
00267 *TRANSDUCER CORRECTION SUBROUTINE*
00268 *****
00269 *SLOPE & INPUT ARE IN ACC'S *
00270 *INTERCEPT IS AT "NUM" *
00271 *RESULT IS RETURNED IN ACC A *
00272 *****

```

```

00274P 0123 8D 7D 01A2 XCER BSR MPY7
00275P 0125 4D TSTA OVERFLOW?
00276P 0126 26 0E 0136 BNE ALLONE YES, BR
00277P 0128 96 00 A LDAA NUM GET INTERCEPT
00278P 012A 4D TSTA + OR - INTERCEPT?
00279P 012B 2A 06 0133 BPL PLUSA BR ON +
00280P 012D 1B ABA
00281P 012E 25 08 0138 BCS END
00282P 0130 4F CLRA RESULT < ZERO
00283P 0131 20 05 0138 BRA END
00284P 0133 1B PLUSA ABA + INTERCEPT
00285P 0134 24 02 0138 BCC END BR IF RESULT < 256
00286P 0136 86 FF A ALLONE LDAA #255
00287P 0138 39 END RTS

```

```

00289 *****
00290 *LINEARIZE SUBROUTINE *
00291 *INX PRESET AT TABLE *
00292 *INPUT IN ACC A *
00293 *RESULT RETURNED IN ACC B*
00294 *****

```

```

00296P 0139 A1 00 A LINEAR CMPA 0,X
00297P 013B 24 05 0142 BCC DELTA
00298P 013D 08 INX
00299P 013E 08 INX
00300P 013F 08 INX
00301P 0140 20 F7 0139 BRA LINEAR
00302P 0142 A0 00 A DELTA SUBA 0,X
00303P 0144 E6 02 A LDAB 2,X SLOPE
00304P 0146 8D 61 01A9 BSR MPY5
00305P 0148 EB 01 A ADDB 1,X
00306P 014A 39 RTS

```

PAGE 007 BADMF A/D CONVERSION, ETC. AHIS 11/4/78

```

00308 *****
00309 *DENSITY ALTITUDE RTN *
00310 *ALTFT IS IN ACC B *
00311 *RESULT STORED ON STACK *
00312 *****

```

```

00314P 014B 86 54 A DALT1 LDAA #PT33
00315P 014D 8D 4C 019B BSR MPYB
00316P 014F 86 6E A LDAA #110
00317P 0151 1B ABA
00318P 0152 D6 09 A LDAB CNVTAB+9 GET TEMPERATURE
00319P 0154 10 SBA
00320P 0155 24 0D 0164 BCC PLSCOR
00321P 0157 40 NEGA
00322P 0158 C6 BF A LDAB #PT75
00323P 015A 8D 3F 019B BSR MPYB
00324P 015C 96 00 A LDAA ALTFT
00325P 015E 11 CBA
00326P 015F 25 0E 016F BCS NEGALT
00327P 0161 10 SBA
00328P 0162 20 10 0174 BRA GO
00329P 0164 C6 AE A PLSCOR LDAB #PT68
00330P 0166 8D 33 019B BSR MPYB
00331P 0168 96 00 A LDAA ALTFT
00332P 016A 1B ABA
00333P 016B 25 05 0172 BCS HIALT BR IF DALT > 255
00334P 016D 20 05 0174 BRA GO
00335P 016F 4F NEGALT CLRA
00336P 0170 20 02 0174 BRA GO
00337P 0172 86 FF A HIALT LDAA #FF
00338P 0174 97 00 A GO STAA DALT
00339P 0176 39 RTS

```

```

00341 *****
00342 * SET CHD FLAG *
00343 *****

```

```

00345P 0177 C6 02 A SETCHD LDAB #2
00346P 0179 D7 00 A STAB CHD INITILIZE CHD
00347P 017B CE 0188 P LDX #HDTABL
00348P 017E A1 00 A HDLP CMPA 0,X (HD = 9K,6K,4K,2K, FEET)
00349P 0180 24 0B 018D BCC DAPK
00350P 0182 7A 0000 A DEC CHD
00351P 0185 0B INX
00352P 0186 20 F6 017E BRA HDLP

00354P 0188 6C A HDTABL FCB 108,72,48,24,0

```

```

00356 *****
00357 * DENSITY ALTITUDE PEAK *
00358 *****
00359P 018D D6 00 A DAPK LDAB VLDLY 12.8 SEC DELAY OVER ?
00360P 018F 2A 4B 01DC BPL GON+1 NO, SKIP PEAKS
00361P 0191 B1 0000 A CMPA FCDAPK PRESENT DALT > PEAK ?
00362P 0194 25 46 01DC BCS GON+1 NO, BR
00363P 0196 B7 0000 A STAA FCDAPK
00364P 0199 20 41 01DC BRA GON+1

```

PAGE 008 BADMP A/D CONVERSION, ETC. AH1S 11/4/78

```

00366 *****
00367 * MULTIPLY SUBROUTINE ACC A X ACC B *
00368 *MOST SIG. HALF OF RESULT RETURNED IN ACC A*
00369 *LEAST SIG. HALF RETURNED IN ACC B *
00370 *****

00372P 019B 36      MPY8  PSHA      *
00373P 019C 86 08    A    LDAA      #8      * RNDOFF NOT 0 *
00374P 019E 97 04    B    STAA      RNDOFF  *ROUND OFF RESULT*
00375P 01A0 20 0D 01AF  BRA      MPY      *
00376P 01A2 36      MPY7  PSHA      *STORE NUMBER OF*
00377P 01A3 86 07    A    LDAA      #7      * FINAL SHIFTS *
00378P 01A5 97 04    B    STAA      RNDOFF  *
00379P 01A7 20 06 01AF  BRA      MPY      *
00380P 01A9 36      MPY5  PSHA      * RNDOFF = 0 *
00381P 01AA 86 05    A    LDAA      #5      *DO NOT ROUNDOFF*
00382P 01AC 7F 0004  B    CLR      RNDOFF  *
00383P 01AF 97 00    A MPY  STAA      SHFTCT *
00384P 01B1 86 08    A LDB      LDAA      #8
00385P 01B3 36      PSHA
00386P 01B4 DF 00    A    STX      MSNDX
00387P 01B6 30      TSX
00388P 01B7 4F      CLRA
00389P 01B8 56      RORB
00390P 01B9 24 02 01BD M3  BCC      M4
00391P 01BB AB 01    A    ADDA      1,X
00392P 01BD 46      M4    RORA
00393P 01BE 56      RORB
00394P 01BF 6A 00    A    DEC      0,X
00395P 01C1 26 F6 01B9  BNE      M3
00396P 01C3 31      INS
00397P 01C4 31      INS
00398P 01C5 7D 0000  A    TST      SHFTCT  ANY FINAL SHIFTS
00399P 01C8 27 0F 01D9  BEQ      RTN
00400P 01CA 44      SHIFT  LSRA
00401P 01CB 56      RORB
00402P 01CC 7A 0000  A    DEC      SHFTCT
00403P 01CF 26 F9 01CA  BNE      SHIFT  BRANCH FOR ANOTHER SHIFT
00404P 01D1 24 06 01D9  BCC      RTN      BR IF FRACTIONAL PART OF
00405 *                                MULTIPLICATION < 0.5
00406P 01D3 7D 0004  B    TST      RNDOFF
00407P 01D6 27 01 01D9  BEQ      RTN      BR IF NO ROUNDOFF
00408P 01DB 5C      INCB

00410P 01D9 DE 00    A RTN  LDX      MSNDX
00411P 01DB 39      GON  RTS

```

PAGE 009 BADMF A/D CONVERSION, ETC. AH15 11/4/78

00413
TOTAL ERRORS 00000

END

D 1000 ACIACS 00004 00017*00085 00087
009D ACIACW 00023*00086
D 1001 ACIAXR 00004 00018*
2000 AD 00019*00132 00141
DP 004F ADCNVT 00005 00106 00118*
2001 ADCR 00020*00081 00134 00136 00139
0034 ADCW 00024*00080 00135
P 0000 ADRTAB 00060*00120
003C ADSTRT 00026*00133
P 0136 ALLONE 00276 00286*
RP ALTABL 00009*00261
RB ALTFT 00014*00263 00324 00331
R ALTINT 00011*00248
R ALTSLP 00011*00252
P 00F6 ASCOR 00229*
R ASINT 00010*00229
R ASSLP 00010*00232
RP ASTABL 00009*00240
P 00C9 CALTH 00188 00196*
P 00CA CALTH1 00180 00197*
RB CHD 00013*00346 00350
P 002E CLRMOR 00091*00093
RB CNVTAB 00013*00122 00152 00157 00181 00206 00212 00224 00230
00234 00250 00254 00318
RB CNZ 00013*00164 00168
RB CT 00013*00103
RB DALT 00013*00338
P 014B DALT1 00264 00314*
P 018D DAPK 00349 00359*
P 0064 DELAY 00128*00131
P 0142 DELTA 00297 00302*
P 013B END 00281 00283 00285 00287*
P 007B ENDCVT 00139*00140
R FCDAPK 00011*00361 00363
R FCOATH 00012*00187 00189
R FCOATL 00012*00182 00184
P 0174 GO 00328 00334 00336 00338*
P 00F4 G01 00219 00224*
P 01DB GON 00360 00362 00364 00411*
P 017E HDLP 00348*00352
P 018B HDTABL 00347 00354*
P 0172 HIALT 00333 00337*
RB KNOTS 00013*00242
P 01B1 LDB 00384*
DP 0139 LINEAR 00006 00241 00262 00296*00301
P 00A2 LOOP 00166*00170
P 01B9 M3 00390*00395
P 01BD M4 00390 00392*
P 01AF MPY 00375 00379 00383*
DP 01A9 MPY5 00007 00304 00380*
DP 01A2 MPY7 00007 00217 00223 00274 00376*
DP 019B MPY8 00007 00315 00323 00330 00372*
RB MSNDX 00014*00386 00410

PAGE 010 BADMP A/D CONVERSION, ETC. AH1S 11/4/78

D 2002 MUX 00005 00021*00079 00095 00100 00126
D 2003 MUXCR 00005 00022*00083 00098
0004 MUXCW 00025*00082
001F MUXID 00027*00078
F 016F NEGALT 00326 00335*
RB NUM 00014*00154 00231 00249 00277
R NZINT 00010*00151
R NZSLP 00010*00155
DP 00AC NZTABL 00006 00165 00172*
F 00C0 OATH 00183 00186*
F 00B2 OATL 00167 00179*
F 0164 PLSCOR 00320 00329*
F 0133 PLUSA 00279 00284*
F 00D3 PLUST 00198 00203*
F 00EC PLUSTF 00214 00220*
0054 PT33 00029*00314
00AE PT68 00030*00329
00BF PT75 00031*00322
F 005B REPEAT 00124*00145
DP 0010 RESTRT 00006 00077*
B 0004 RNDOFF 00035*00374 00378 00382 00406
F 01D9 RTN 00399 00404 00407 00410*
B 0000 SAVADR 00033*00121 00124 00137
B 0002 SAVCNV 00034*00123 00138 00143
F 0177 SETCHD 00107 00345*
RB SHFTCT 00014*00383 00398 00402
DP 01CA SHIFT 00007 00400*00403
D 00FF STACK 00004 00016*00077
DP 0049 TENHZ 00006 00105*
F 00D9 TMANS 00202 00206*
RB VLDLY 00014*00179 00359
DP 0123 XCER 00006 00156 00233 00253 00274*
F 003B XX 00098*00099 00102

PAGE 001 SVLVH VL,VH,NZ PEAKS AH1S 11/4/78

00001 NAM SVLVH
00002 OPT REL,CREF,NOG

00004 TTL VL,VH,NZ PEAKS AH1S 11/4/78

00006 *****
00007 * CALCULATE VL, STORE AT ONEVL, SET CVL *
00008 * FCVLPK PEAK VL AFTER 12.8 SEC DELAY *
00009 * CALCULATE VH, STORE AT ONEVH, SET CVH *
00010 * FCVHPK PEAK VH AFTER 12.8 SEC DELAY *
00011 * FCPKNZ PEAK NZ INAIR 12.8 SEC DELAY *
00012 * DIVIDE SUBROUTINE *
00013 *****

00015 XDEF DIVIDE

00017 XREF PSCT:MPY8,MPY7
00018 XREF ANY:FCVHPK,FCVLPK,FCPKNZ
00019 XREF BSCT:DALT,KNOTS,CNVTAB,NUM,ZERO
00020 XREF BSCT:VLDLY,CVL,CVH

00022 0026 A PT15 EQU 38 38/256=0.148
00023 002B A PT17 EQU 43 43/256=0.168
00024 00F3 A PT95 EQU 243 243/256=0.95

00026 *-----
00027 * VH <.3 .3-.5 .5-.6 .6-.7 .7-.8
00028 *CVH -2 -1 0 1 2

00030 * VH .8-.9 .9-1.0 1.0-1.1 >1.1
00031 *CVH 3 4 5 6
00032 *-----

00034 *-----
00035 * VL <.7 .7-.85 .85-.95 >.95
00036 *CVL -1 0 1 2
00037 *-----

00039B 0000 BSCT
00040B 0000 0001 A ONEVL RMB 1
00041B 0001 0001 A ONEVH RMB 1
00042B 0002 0001 A ANS RMB 1
00043B 0003 0001 A DENOM RMB 1
00044B 0004 0001 A NZTM RMB 1
00045B 0005 0002 A NZPKS RMB 2

PAGE 002 SVLVH VL,VH,NZ PEAKS AHIS 11/4/78

00048P 0000

FSCT

00050 *****
00051 * CALCULATE ONEVL *
00052 *DALT STARTS IN ACC A *
00053 *****

00055P 0000 DE 00 A VL LDX ZERO CLEAR X
00056P 0002 80 24 A SUBA #36
00057P 0004 25 0A 0010 BCS LOW BR IF DALT < 36 (3000 FT)
00058P 0006 C6 AB A LDAB #171
00059P 0008 BD 0000 A JSR MPY8
00060P 000B 86 B4 A LDAA #180
00061P 000D 10 SBA
00062P 000E 20 02 0012 BRA ENDVL
00063P 0010 86 B4 A LOW LDAA #180
00064P 0012 97 00 B ENDVL STAA ONEVL

00066 *****
00067 *SET CVL FLAG*
00068 *****
00069P 0014 C6 02 A LDAB #2
00070P 0016 D7 00 A STAB CVL
00071P 0018 C6 F3 A LDAB #PT95
00072P 001A BD 0000 A JSR MPY8 .95VL RET'N IN ACC B
00073P 001D D1 00 A CMPB KNOTS .95VL - KNOTS
00074P 001F 25 14 0035 BCS VLPEAK BR IF KNOTS > .95VL
00075P 0021 C6 26 A LDAB #PT15
00076P 0023 96 00 B LDAA ONEVL
00077P 0025 BD 0000 A JSR MPY8 .15VL RET'N IN ACC B
00078P 002B 96 00 B LDAA ONEVL
00079P 002A 6A 00 A AGAIN1 DEC CVL,X
00080P 002C 2B 07 0035 BMI VLPEAK BR IF CVL = -1 (<.7VL)
00081P 002E 10 SBA
00082P 002F 91 00 A CMPA KNOTS
00083P 0031 25 02 0035 BCS VLPEAK BR IF XVL < KNOTS
00084P 0033 20 F5 002A BRA AGAIN1

00086 *****
00087 *CHECK VL PEAK FCC*
00088 *****

00090P 0035 6D 00 A VLPEAK TST VLDLY,X 12.8 SEC DELAY OVER?
00091P 0037 2B 04 003D BMI DOIT YES,BR
00092P 0039 6C 00 A INC VLDLY,X
00093P 003B 20 0F 004C BRA VH SKIP VL PEAK
00094P 003D 96 00 A DOIT LDAA KNOTS
00095P 003F D6 00 B LDAB ONEVL
00096P 0041 8D 4D 0090 BSR DIVIDE XVL IN ACC A
00097P 0043 F6 0000 A LDAB FCVLPK
00098P 0046 11 CBA
00099P 0047 25 03 004C BCS VH PRESENT VL - PEAK VL
00100P 0049 B7 0000 A STAA FCVLPK BR IF PEAK > PRESENT

9
F

PAGE 003 SULVH VL,VH,NZ PEAKS AH15 11/4/78

```

00102
00103 *****
00104 *CALCULATE ONEVH*
*****

00106P 004C 96 00 A VH LDAA DALT GET DENSITY ALTITUDE
00107P 004E C6 2B A LDAB #PT17
00108P 0050 BD 0000 A JSR MPYB
00109P 0053 86 90 A LDAA #144
00110P 0055 10 SBA
00111P 0056 97 01 B STAA ONEVH

```

```

00113 *****
00114 *SET CVH FLAG*
00115 *****

00116P 0058 C6 06 A LDAB #6
00117P 005A D7 00 A STAB CVH INITIALIZE CVH
00118P 005C C6 8D A LDAB #141 141/128=1.10
00119P 005E 36 V1 PSHA
00120P 005F 37 PSHB
00121P 0060 BD 0000 A JSR MPY7 ANS RET'N IN ACC B
00122P 0063 D1 00 A CMPB KNOTS ZVH < KNOTS ?
00123P 0065 23 11 007B BLS V3 YES,BR
00124P 0067 7A 0000 A DEC CVH
00125P 006A 33 PULB
00126P 006B 32 PULA
00127P 006C C0 0D A V2 SUBB #13 SUBTRACT 0.10
00128P 006E C1 32 A CMPB #50 .40 VH ?
00129P 0070 27 FA 006C BEQ V2 YES,BR
00130P 0072 C1 18 A CMPB #24 .20 VH ?
00131P 0074 26 E8 005E BNE V1 NO,BR
00132P 0076 20 02 007A BRA VHPK
00133P 0078 31 V3 INS
00134P 0079 31 INS

```

```

00136 *****
00137 * CHECK VH PEAK FCC *
00138 *****

00140P 007A 7D 0000 A VHPK TST VLDLY 12.8 SEC SINCE POWER ON ?
00141P 007D 2A 61 00E0 BPL GO+2 NO,BR (SKIP PEAKS)
00142P 007F 96 00 A LDAA KNOTS
00143P 0081 D6 01 B LDAB ONEVH
00144P 0083 8D 0B 0090 BSR DIVIDE
00145P 0085 F6 0000 A LDAB FCVHPK
00146P 0088 11 CBA
00147P 0089 25 2B 00B6 BCS NZPEAK IS PRESENT VALUE > PEAK ?
00148P 008B B7 0000 A STAA FCVHPK NO,BR
00149P 008E 20 26 00B6 BRA NZPEAK

```

```

00151 *****
00152 * DIVIDE SUBROUTINE *
00153 *****
00154 * NUMERATOR IN ACC A *
00155 * DENOMINATOR IN ACC B *
00156 *(NUM X 128)/DEN = ANS *
00157 *****

```

```

00159P 0090 D7 03 B DIVIDE STAB DENOM
00160P 0092 26 04 009B BNE OK BR IF DENOM NOT ZERO
00161P 0094 86 FF A LDAA #$FF
00162P 0096 20 1D 00B5 BRA SMALL EXIT
00163P 0098 5F OK CLRB
00164P 0099 D7 02 B STAB ANS CLEAR ANS
00165P 009B 97 00 A STAA NUM
00166P 009D 44 LSRA
00167P 009E 56 RORB
00168P 009F 4D TSTA
00169P 00A0 26 04 00A6 BNE SUBT BR IF NUM WAS > 1
00170P 00A2 D1 03 B CMPB DENOM
00171P 00A4 25 0F 00B5 BCS SMALL BR IF DENOM > (NUM X 128)
00172P 00A6 D0 03 B SUBT SUBB DENOM
00173P 00A8 7C 0002 B INC ANS
00174P 00AB 92 00 A SBCA ZERO SUBTRACT POSSIBLE BORROW
00175P 00AD 26 F7 00A6 BNE SUBT BR IF NOT ZERO
00176P 00AF D1 03 B CMPB DENOM
00177P 00B1 24 F3 00A6 BCC SUBT BR IF ACC B > DENOM
00178P 00B3 96 02 B LDAA ANS
00179P 00B5 39 SMALL RTS

```

```

00181 *****
00182 * NZPEAK *
00183 * ROUTINE *
00184 * AIR ONLY *
00185 *****

```

```

00187P 00B6 96 06 A NZPEAK LDAA CNVTAB+6 CORRECTED NZ
00188P 00B8 91 05 B CMPA NZPKS NZ > PRESENT PEAK?
00189P 00BA 25 02 00BE BCS SKP2 NO,BR
00190P 00BC 97 05 B STAA NZPKS UPDATE PRESENT PEAK
00191P 00BE 96 04 B SKP2 LDAA NZTM
00192P 00C0 4C INCA
00193P 00C1 97 04 B STAA NZTM
00194P 00C3 81 0A A CMPA #10 1 SEC SINCE GND?
00195P 00C5 26 03 00CA BNE SKP3 NO,BR
00196P 00C7 7F 0005 B CLR NZPKS
00197P 00CA 81 14 A SKP3 CMPA #20 TIME = 2 SEC ?
00198P 00CC 26 12 00E0 BNE GO+2
00199P 00CE 64 04 B LSR NZTM,X RESET TIMER TO 1 SEC
00200P 00D0 96 06 B LDAA NZPKS+1 GET PREVIOUS 1 SEC PEAK
00201P 00D2 B1 0000 A CMPA FCCPNZ PREVIOUS>FCCPEAK?
00202P 00D5 25 03 00DA BCS SKP4 NO,BR
00203P 00D7 B7 0000 A STAA FCCPNZ
00204P 00DA 96 05 B SKP4 LDAA NZPKS
00205P 00DC 97 06 B STAA NZPKS+1
00206P 00DE 6F 05 B GO CLR NZPKS,X
00207 END
TOTAL ERRORS 00000

```

PAGE 005 SULUH VL,VH,NZ PEAKS AHIS 11/4/78

F 002A AGAIN1 00079*00084
B 0002 ANS 00042*00164 00173 00178
RB CNVTAB 00019*00187
RB CVH 00020*00117 00124
RB CVL 00020*00070 00079
RB DALT 00019*00106
B 0003 DENOM 00043*00159 00170 00172 00176
DP 0090 DIVIDE 00015 00096 00144 00159*
P 003D DQIT 00091 00094*
P 0012 ENDVL 00062 00064*
R FCPKNZ 00018*00201 00203
R FCVHPK 00018*00145 00148
R FCULPK 00018*00097 00100
P 00BE GO 00141 00198 00206*
RB KNOTS 00019*00073 00082 00094 00122 00142
P 0010 LOW 00057 00063*
RP MPY7 00017*00121
RP MPY8 00017*00059 00072 00077 00108
RB NUM 00019*00165
P 00B6 NZPEAK 00147 00149 00187*
B 0005 NZPKS 00045*00188 00190 00196 00200 00204 00205 00206
B 0004 NZTM 00044*00191 00193 00199
P 0098 OK 00160 00163*
B 0001 ONEVH 00041*00111 00143
B 0000 ONEVL 00040*00064 00076 00078 00095
0026 PT15 00022*00075
0028 PT17 00023*00107
00F3 PT95 00024*00071
P 00BE SKP2 00189 00191*
P 00CA SKP3 00195 00197*
P 00DA SKP4 00202 00204*
P 00B5 SMALL 00162 00171 00179*
P 00A6 SUBT 00169 00172*00175 00177
P 005E V1 00119*00131
P 006C V2 00127*00129
P 0078 V3 00123 00133*
P 004C VH 00093 00099 00106*
P 007A VHPK 00132 00140*
P 0000 VL 00055*
RB VLDLY 00020*00090 00092 00140
P 0035 VLPEAK 00074 00080 00083 00090*
RB ZERO 00019*00055 00174

PAGE 001 SRT3 ROLL,TORQUE,RPM AHIS 1/26/79

00001 NAM SRT3
00002 TTL ROLL,TORQUE,RPM AHIS 1/26/79
00003 OPT REL,NOG,CREF

00005 *****
00006 * CORRECT ROLL FOR REFERENCE, SET CROL *
00007 * FCRLPK ROLL PEAK AFTER 12.8 SEC DELAY *
00008 * CORRECT TORQUE FOR REFERENCE *
00009 * CORRECT TORQUE FOR SLOPE/INTERCEPT *
00010 * SET CQ *
00011 * FCTQPK TORQUE PEAK AFTER 12.8 SEC DELAY *
00012 * SET CRPM *
00013 * FCRPMP RPM PEAK AFTER 12.8 SEC DELAY *
00014 *****

00016 *-----
00017 *ROLL <10 DEG 10-25 25-35 >35
00018 *CROL -1 0 1 2
00019 *-----

00021 *-----
00022 *TORQUE <10 10-20 20-30 30-40 40-50 >50
00023 * CQ -1 0 1 2 3 4
00024 *-----

00026 *-----
00027 * RPM <250 250-314 314-319 319-324 324-329
00028 *CRPM -4 -3 -2 -1 0
00029 *-----

00031 *-----
00032 * RPM 329-334 334-339 >339
00033 *CRPM 1 2 3
00034 *-----

00036 XDEF QTABLE,RPMTBL

00038 XREF ANY:FCPKNZ,TQINT,TQSLP,FCTQPK
00039 XREF ANY:FCRPMP,FCRLPK
00040 XREF PSCT:XCER,DIVIDE
00041 XREF BSCT:ACOFF,ZERO,CNVTAB,PMONTH
00042 XREF BSCT:VLDLY,CQ,CROL,CRPM,NUM

00044 002C A DEG10 EQU 44 ROLL = 10 DEGREES THRESHOL
00045 006E A DEG25 EQU 110 ROLL = 25 DEGREES THRESHOL
00046 0093 A DEG35 EQU 147 ROLL = 35 DEGREES THRESHOL

PAGE 002 SRT3 ROLL,TORQUE,RPM AHIS 1/26/79

```
00048P 0000          PSCT
00049          *****
00050          *   CORRECT ROLL FOR REFERENCE   *
00051          *****
```

```
00054P 0000 DE 00    A ROLL1 LDX      ZERO
00055P 0002 D6 02    A        LDAB    CNVTAB+2 SYNCHRO REFERENCE
00056P 0004 96 01    A        LDAA    CNVTAB+1 ROLL
00057P 0006 C1 91    A        CMPB    #145
00058P 0008 24 21 002B      BCC      OUT1      BR IF REF > 145
00059P 000A C1 6F    A        CMPB    #111
00060P 000C 25 1D 002B      BCS      OUT1      BR IF REF < 111
00061P 000E 6F 00    A        CLR      ACOFF,X  CLEAR 'AC POWER OFF' FLAG
00062P 0010 BD 0000  A        JSR      DIVIDE   CORRECT ROLL RETN IN ACC A
```

```
00064          *****
00065          *   SET CROL FLAG   *
00066          *****
```

```
00068P 0013 C6 02    A        LDAB    #2
00069P 0015 D7 00    A        STAB    CROL      INITILIZE CROL
00070P 0017 81 93    A        CMPA    #DEG35
00071P 0019 24 18 0033      BCC      RLPK      BR IF ROLL > 35
00072P 001B 6A 00    A        DEC      CROL,X
00073P 001D 81 6E    A        CMPA    #DEG25
00074P 001F 24 12 0033      BCC      RLPK
00075P 0021 6A 00    A        DEC      CROL,X
00076P 0023 81 2C    A        CMPA    #DEG10
00077P 0025 24 0C 0033      BCC      RLPK
00078P 0027 6A 00    A        DEC      CROL,X
00079P 0029 20 08 0033      BRA      RLPK
00080P 002B 86 FF    A OUT1    LDAA    #-1
00081P 002D 97 00    A        STAA    CROL
00082P 002F 97 00    A        STAA    ACOFF
00083P 0031 20 0C 003F      BRA      SETCQ
```

```
00085          *****
00086          *   ROLL PEAK   *
00087          *****
```

```
00089P 0033 D6 00    A RLPK    LDAB    VLDLY    12.8 SEC DELAY OVER ?
00090P 0035 2A 08 003F      BPL      SETCQ    NO, SKIP PEAK
00091P 0037 B1 0000  A        CMPA    FCRLPK   PRESENT ROLL > PEAK ?
00092P 003A 25 03 003F      BCS      SETCQ    NO,BR
00093P 003C B7 0000  A        STAA    FCRLPK
```

PAGE 003 SRT3 ROLL,TORQUE,RPM AHIS 1/26/79

```

00095 *****
00096 *      SET CQ FLAG      *
00097 *****

00099P 003F 96 04  A SETCQ LDAA CNVTAB+4 TORQUE 1
00100P 0041 D6 05  A LDAB CNVTAB+5 TORQUE REFERENCE
00101P 0043 C1 9C  A CMPB #156 TOO HIGH ?
00102P 0045 24 39 0080 BCC OUT2 YES,BR
00103P 0047 C1 6F  A CMPB #111 TOO LOW ?
00104P 0049 25 35 0080 BCS OUT2 YES BR
00105P 004B BD 0000 A JSR DIVIDE
00106P 004E F6 0000 A LDAB TQINT TORQUE INTERCEPT
00107P 0051 D7 00  A STAB NUM STORE INT FOR XCER
00108P 0053 F6 0000 A LDAB TQSLP TORQUE SLOPE
00109P 0056 BD 0000 A JSR XCER CORRECTION RTN IN A
00110P 0059 97 04  A STAA CNVTAB+4 STORE CORRECTED TQ AVG

00112P 005B C6 FF  A LDAB #-1
00113P 005D D7 00  A STAB CQ INITILIZE CQ
00114P 005F CE 006C P LDX #QTABLE
00115P 0062 A1 00  A CQLP CMPA 0,X (TQ=10 20 30 40 50 PSI)
00116P 0064 25 0C 0072 BCS TQPK BR IF TQ > TABLE VALUE
00117P 0066 7C 0000 A INC CQ
00118P 0069 08 INX
00119P 006A 20 F6 0062 BRA CQLP
00120P 006C 14 A QTABLE FCB 20,40,60,80,100,255

00122 *****
00123 *      TORQUE PEAK      *
00124 *****

00126P 0072 D6 00  A TQPK LDAB VLDLY 12.8 SEC DELAY OVER ?
00127P 0074 2A 0D 0083 BPL RPM1 NO, SKIP PEAK
00128P 0076 B1 0000 A CMPA FCTQPK TQ VALUE > PK?
00129P 0079 25 08 0083 BCS RPM1 NO,BR
00130P 007B B7 0000 A STAA FCTQPK
00131P 007E 20 03 0083 BRA RPM1

00133P 0080 5F OUT2 CLRAB SET TO 10-20 PSI
00134P 0081 D7 00  A STAB CQ

00136 *****
00137 *      SET CRPM FLAG      *
00138 *****

00140P 0083 86 03  A RPM1 LDAA #3
00141P 0085 97 00  A STAA CRPM INITILIZE CRPM
00142P 0087 4A DECA
00143P 0088 91 00  A CMPA PWONTH
00144P 008A 25 04 0090 BCS RPM2
00145P 008C 86 FF  A LDAA #FF SET RPM FLAG TO < 250
00146P 008E 97 00  A STAA CNVTAB+0
00147P 0090 96 00  A RPM2 LDAA CNVTAB+0 RPM
00148P 0092 43 COMA
00149P 0093 CE 00A0 P LDX #RPMTHL

```


PAGE 004 SRT3 ROLL,TORQUE,RPM AHIS 1/26/79

00151P 0096 A1 00 A RPMLP CMFA 0,X
00152 * (RPM = 339,334,329,324,319,314,250)
00153P 0098 24 0E 00A8 BCC RPMPK BR IF RPM > TABLE VALUE
00154P 009A 7A 0000 A DEC CRPM
00155P 009D 08 INX
00156P 009E 20 F6 0096 BRA RPMLP
00157 * CNT = (255/80)(5/1.62)[80 - RPM(71.75/324)]
00158P 00A0 D0 A RPMTBL FCB 208,197,186,175,164,153,14,0

00160 *****
00161 * RPM PEAK *
00162 *****

00164P 00A8 D6 00 A RPMPK LDAB VLDLY 12.8 SEC DELAY OVER ?
00165P 00AA 2A 08 00B8 BPL GO+3 NO,SKIP PEAK
00166P 00AC B1 0000 A CMFA FCRPMP RPM VALUE > PEAK?
00167P 00AF 25 03 00B4 BCS GO+3 NO,BR
00168P 00B1 B7 0000 A GO STAA FCRPMP
00169 END
TOTAL ERRORS 00000

RB ACOFF 00041*00061 00082
RB CNVTAB 00041*00055 00056 00099 00100 00110 00146 00147
RB CO 00042*00113 00117 00134
P 0062 CQLP 00115*00119
RB CROL 00042*00069 00072 00075 00078 00081
RB CRPM 00042*00141 00154
002C DEG10 00044*00076
006E DEG25 00045*00073
0093 DEG35 00046*00070
RP DIVIDE 00040*00062 00105
R FCPKNZ 00038*
R FCRLPK 00039*00091 00093
R FCRPMP 00039*00166 00168
R FCTQPK 00038*00128 00130
P 00B1 GO 00165 00167 00168*
RB NUM 00042*00107
P 002B OUT1 00058 00060 00080*
P 0080 OUT2 00102 00104 00133*
RB PWONTH 00041*00143
DP 006C QTABLE 00036 00114 00120*
P 0033 RLPK 00071 00074 00077 00079 00089*
P 0000 ROLL1 00054*
P 0083 RPM1 00127 00129 00131 00140*
P 0090 RPM2 00144 00147*
P 0096 RPMLP 00151*00156
P 00A8 RPMPK 00153 00164*
DP 00A0 RPMTBL 00036 00149 00158*
P 003F SETCQ 00083 00090 00092 00099*
R TQINT 00038*00106
P 0072 TQPK 00116 00126*
R TQSLP 00038*00108
RB VLDLY 00042*00089 00126 00164
RP XCER 00040*00109
RB ZERO 00041*00054

PAGE 001 ST01 TAKEOFF AND LANDING DETECTION 3/10/80

00001			NAM	ST01	
00002					
00003			TTL	TAKEOFF AND LANDING DETECTION 3/10/	
00004			OPT	REL,N0G,CREF	
00005					
00006			XREF	KNOTS,CNVTAB,CQ,CT	
00007			XREF	CRPM,GROSNT,CGW	
00008B	0000		BSCT		
00009B	0000	0001	A GSAMP	RMB 1	INITIAL GROUND SAMPLE FLAG
00010B	0001	0001	A RMAX	RMB 1	MAXIMUM ROLL
00011B	0002	0001	A RMIN	RMB 1	MINIMUM ROLL
00012B	0003	0001	A NZMAX	RMB 1	MAXIMUM NZ
00013B	0004	0001	A NZMIN	RMB 1	MINIMUM NZ
00014B	0005	0001	A RTIM	RMB 1	ROLL TIMER
00015B	0006	0001	A RLMAX	RMB 1	LANDING ROLL MAX
00016B	0007	0001	A RLMIN	RMB 1	LANDING ROLL MIN
00017B	0008	0001	A SFROLL	RMB 1	ROLL FLAG
00018B	0009	0001	A NTIM	RMB 1	NZ TIMER
00019B	000A	0001	A NLMAX	RMB 1	NZ LANDING MAX
00020B	000B	0001	A NLMIN	RMB 1	NZ LANDING MIN
00021B	000C	0001	A SFNZ	RMB 1	NZ FLAG
00022B	000D	0001	A ASLFQW	RMB 1	LONG TIME A/S FLAG
00023B	000E	0001	A TQDROP	RMB 1	TORQUE FLAG
00024B	000F	0001	A TQLFQW	RMB 1	LONG TIME TORQUE FLAG
00025B	0010	000A	A TDTBLE	RMB 10	1 SEC TO HISTORY TABLE
00026B	001A	0001	A ASTIME	RMB 1	AIR SPEED LOW TIMER
00027B	001B	0001	A TQTIME	RMB 1	TORQUE LOW TIMER
00028					
00029P	0000		PSCT		
00030					
00031			*	THIS SECTION DETECTS AND SIGNALS TAKEOFFS	
00032			*	BY CHECKING AIRSPEED AND ACCELERATION.	
00033			*	TAKEOFF IS SIGNALLED BY SETTING CT EQUAL	
00034			*	TO ZERO.	
00035P	0000	7D 0000	A	TST CT	ALREADY IN AIR?
00036P	0003	27 68 006D		BEQ FINI	YES,BRANCH
00037P	0005	B6 0000	A	LDAA CRPM	GET RPM
00038P	0008	81 FC	A	CMPA #4	RPM<250
00039P	000A	27 61 006D		BEQ FINI	YES,BRANCH
00040P	000C	B6 0000	A	LDAA KNOTS	GET AIRSPEED
00041P	000F	81 28	A	CMPA #40	A/S>40?
00042P	0011	2E 4A 005D		BGT INAIR	YES,BRANCH
00043P	0013	7D 0000	B	TST GSAMP	GROUND FLAG SET?
00044P	0016	2E 12 002A		BGT SKIP	YES,BRANCH
00045P	0018	B6 000A	A	LDAA CNVTAB+10	GET ROLL
00046P	001B	97 01	B	STAA RMAX	STORE MAX
00047P	001D	97 02	B	STAA RMIN	STORE MIN
00048P	001F	B6 0006	A	LDAA CNVTAB+6	GET NZ
00049P	0022	97 03	B	STAA NZMAX	STORE MAX
00050P	0024	97 04	B	STAA NZMIN	STORE MIN
00051P	0026	86 01	A	LDAA #1	
00052P	0028	97 00	B	STAA GSAMP	SET GROUND FLAG
00053P	002A	7D 0000	A SKIP	TST CQ	TEST TORQUE
00054P	002D	2D 3E 006D		BLT FINI	<5,BRANCH
00055P	002F	B6 000A	A	LDAA CNVTAB+10	GET ROLL
00056P	0032	91 01	B	CMPA RMAX	>MAX?
00057P	0034	2D 02 003B		BLT SKIP2	NO,BRANCH
00058P	0036	97 01	B	STAA RMAX	NEW MAX

PAGE 002 ST01 TAKEOFF AND LANDING DETECTION 3/10/80

```

00059F 003B 91 02 B SKIP2 CMFA RMIN ROLL<MIN?
00060F 003A 2E 02 003E BGT SKIP3 NO,BRANCH
00061F 003C 97 02 B STAA RMIN NEW MIN
00062F 003E 96 01 B SKIP3 LDAA RMAX
00063F 0040 90 02 B SUBA RMIN MAX-MIN
00064F 0042 81 16 A CMFA #22 >2 DEGREES?
00065F 0044 2E 17 005D BGT INAIR YES,BRANCH
00066F 0046 B6 0006 A LDAA CNVTAB+6 GET NZ
00067F 0049 91 03 B CMFA NZMAX >MAX?
00068F 004B 2D 02 004F BLT SKIP4 NO,BRANCH
00069F 004D 97 03 B STAA NZMAX NEW MAX
00070F 004F 91 04 B SKIP4 CMFA NZMIN <MIN?
00071F 0051 2E 02 0055 BGT SKIP5 NO,BRANCH
00072F 0053 97 04 B STAA NZMIN NEW MIN
00073F 0055 96 03 B SKIP5 LDAA NZMAX
00074F 0057 90 04 B SUBA NZMIN MAX-MIN
00075F 0059 81 04 A CMFA #4
00076F 005B 2D 10 006D BLT FINI BRANCH IF >1
00077F 005D 4F INAIR CLRA
00078F 005E B7 0000 A STAA CT SET TAKEOFF
00079F 0061 97 00 B STAA GSAMP SET GROUND FLAG=0
00080F 0063 86 01 A LDAA #1
00081F 0065 B7 0000 A STAA CGW SET CGW
00082F 0068 86 50 A LDAA #80
00083F 006A B7 0000 A STAA GROSSWT SET GROSS WEIGHT
00084F 006D 01 FINI NOP
00085 *
00086 * THIS SECTION OF CODE SETS A FLAG (TQDROP) TO
00087 * INDICATE IF TORQUE IS VARYING AT A RATE SUCH
00088 * THAT THE EQUATION OF TORQUE AS A FUNCTION OF
00089 * TIME HAS A SLOPE OF -2 OR LESS. IN OTHER
00090 * WORDS TORQUE IS DROPPING RAPIDLY.
00091 *
00092 *
00093 * UPDATE TORQUE HISTORY TABLE
00094 *
00095F 006E 7D 0000 A TST CT IN AIR YET?
00096F 0071 26 28 009B BNE TDOUT NO,BRANCH
00097F 0073 CE 0010 B LDY #TDTBLE POINT TO START OF TABLE
00098F 0076 C6 09 A LDAB #9 NUMBER OF ITERATIONS
00099F 0078 A6 01 A TQLOOP LDAA 1,X MOVE BYTES DOWN THRU TABLE
00100F 007A A7 00 A STAA 0,X
00101F 007C 08 INX
00102F 007D 5A DECB TEST FOR END OF LOOP
00103F 007E 26 F8 007B BNE TQLOOP
00104F 0080 B6 0004 A LDAA CNVTAB+4 GET CURRENT TORQUE
00105F 0083 A7 00 A STAA 0,X PIT IN TORQUE TABLE
00106 *
00107 * COMPUTE SLOPE
00108 *
00109F 0085 D6 10 B LDAB TDTBLE GET VALUE 1 SEC AGO
00110F 0087 10 SBA SUBTRACT OLD FROM CURRENT
00111 *
00112 * SET TORQUE DROP FLAG
00113 *
00114F 0088 81 FE A CMFA #-2 TEST FOR NEGATIVE SLOPE
00115F 008A 2E 08 0094 BGT HISLOP NO - BRANCH
00116F 008C 7F 000E B CLR TQDROP SET TORQUE DROP FLAG TRUE

```

PAGE 003 S101 TAKEOFF AND LANDING DETECTION 3/10/80

00117P 008F 7C 000E B	INC	TQDROP	
00118P 0092 20 07 009B	BRA	TDOUT	
00119P 0094 81 02 A	HISLOP	CMFA	#2
00120P 0096 2D 03 009B	BLT	TDOUT	TEST FOR POSITIVE SLOPE
00121P 0098 7F 000E B	CLR	TQDROP	NO - BRANCH
00122P 009B 01	TDOUT	NOF	SET TORQUE DROP FLAG FALSE
00123			
00124			
00125P 009C 7D 0000 A	***	ROLL AND NZ CHECK	***
00126P 009F 26 6A 010B	TST	CT	IN AIR YET?
00127P 00A1 B6 000A A	BNE	RS10	NO BRANCH
00128P 00A4 7D 0005 B	LDAA	CNVTAB+10	GET ROLL
00129P 00A7 2E 04 00AD	TST	RTIM	IS TIMER RUNNING?
00130P 00A9 97 06 B	BGT	RS1	YES, BRANCH
00131P 00AB 97 07 B	STAA	RLMAX	STORE MAX
00132P 00AD 91 06 B	STAA	RLMIN	STORE MIN
00133P 00AF 2F 02 00B3	CMFA	RLMAX	
00134P 00B1 97 06 B	BLE	RS2	LESSTHAN MAX, BRANCH
00135P 00B3 91 07 B	STAA	RLMAX	NEW MAX
00136P 00B5 2C 02 00B9	CMFA	RLMIN	
00137P 00B7 97 07 B	BGE	RS3	GREATER THAN MIN, BRANCH
00138P 00B9 96 06 B	STAA	RLMIN	NEW MIN
00139P 00BB 90 07 B	LDAA	RLMAX	
00140P 00BD 81 16 A	SUBA	RLMIN	MAX-MIN
00141P 00BF 2D 08 00C9	CMFA	#22	DIFFERENCE>2 DEGREES?
00142P 00C1 7F 0005 B	BLT	RS4	NO, BRANCH
00143P 00C4 7F 0008 B	CLR	RTIM	YES, RESET TIMER
00144P 00C7 20 0D 00D6	CLR	SFROLL	RESET ROLL FLAG
00145P 00C9 7C 0005 B	BRA	RS5	
00146P 00CC 96 05 B	INC	RTIM	INC TIMER
00147P 00CE 81 3C A	LDAA	RTIM	
00148P 00D0 2D 04 00D6	CMFA	#60	TIMER=6 SEC?
00149P 00D2 86 01 A	BLT	RS5	NO, BRANCH
00150P 00D4 97 08 B	LDAA	#1	
00151P 00D6 B6 0006 A	STAA	SFROLL	SET ROLL FLAG
00152P 00D9 7D 0009 B	LDAA	CNVTAB+6	GET NZ
00153P 00DC 2E 04 00E2	TST	NTIM	TIMER RUNNING?
00154P 00DE 97 0A B	BGT	RS6	YES, BRANCH
00155P 00E0 97 0B B	STAA	NLMAX	STORE MAX
00156P 00E2 91 0A B	STAA	NLMIN	STORE MIN
00157P 00E4 2F 02 00EB	CMFA	NLMAX	
00158P 00E6 97 0A B	BLE	RS7	LESS THAN MAX, BRANCH
00159P 00E8 91 0B B	STAA	NLMAX	NEW MAX
00160P 00EA 2C 02 00EE	CMFA	NLMIN	
00161P 00EC 97 0B B	BGE	RS8	MORE THAN MIN, BRANCH
00162P 00EE 96 0A B	STAA	NLMIN	NEW MIN
00163P 00F0 90 0B B	LDAA	NLMAX	
00164P 00F2 81 04 A	SUBA	NLMIN	MAX-MIN
00165P 00F4 2F 0B 00FE	CMFA	#4	DIFFERENCE>.067 G?
00166P 00F6 7F 0009 B	BLE	RS9	NO, BRANCH
00167P 00F9 7F 000C B	CLR	NTIM	YES, RESET TIMER
00168P 00FC 20 0D 010B	CLR	SFNZ	RESET NZ FLAG
00169P 00FE 7C 0009 B	BRA	RS10	
00170P 0101 96 09 B	INC	NTIM	INC TIMER
00171P 0103 81 3C A	LDAA	NTIM	
00172P 0105 2D 04 010B	CMFA	#60	TIMER=6 SEC?
00173P 0107 86 01 A	BLT	RS10	NO, BRANCH
00174P 0109 97 0C B	LDAA	#1	
	STAA	SFNZ	SET NZ FLAG

PAGE 004 ST01 TAKEOFF AND LANDING DETECTION 3/10/80

```

00175P 010B 01      RS10  NOP
00176                *
00177                * THIS SECTION OF CODE DETERMINES IF AIR SPEED
00178                * HAS REMAINED BELOW A CERTAIN VALUE FOR A
00179                * CERTAIN PERIOD OF TIME. IF SO IT SETS THE AIR
00180                * SPEED LOW FOR QUITE A WHILE FLAG (ASLFQW)
00181                *
00182P 010C B6 0000 A      LDAA  KNOTS      TEST AIR SPEED > 40 KNOTS
00183P 010F 81 28      A      CMFA  #40
00184P 0111 2E 0F 0122    BGT  ASHIGH     BRANCH IF AIR SPEED > 40
00185P 0113 7C 001A B      INC  ASTIME     BUMP CONDITION TRUE TIMER
00186P 0116 96 1A      B      LDAA  ASTIME     CONDITIN TRUE AT LEAST 10
00187P 0118 81 64      A      CMFA  #100
00188P 011A 2D 0C 0128    BLT  ASOUT      NO - THEN DONT SET FLAG YE
00189P 011C 86 01      A      LDAA  #1
00190P 011E 97 0D      B      STAA  ASLFQW     SET AIR SPEED LOW FLAG
00191P 0120 20 06 0128    BRA  ASOUT
00192P 0122 7F 000D B ASHIGH CLR  ASLFQW     CLEAR AIR SPEED LOW FLAG
00193P 0125 7F 001A B      CLR  ASTIME     CLEAR CONDITION TRUE TIMER
00194P 0128 01      ASOUT  NOP
00195                *
00196                * THIS SECTION OF CODE DETERMINES IF TORQUE HAS
00197                * REMAINED BELOW A CERTAIN VALUE FOR A CERTAIN
00198                * PERIOD OF TIME. IF SO IT SETS THE TORQUE LOW
00199                * FOR QUITE A WHILE FLAG (TQLFQW).
00200                *
00201P 0129 7D 0000 A      TST  CQ        TORQUE < 5
00202P 012C 2A 0F 013D    BPL  TQHIGH     NO - BRANCH
00203P 012E 7C 001B B      INC  TQTIME     BUMP CONDITION TRUE TIMER
00204P 0131 96 1B      B      LDAA  TQTIME     CONDITION TRUE AT LEAST 10
00205P 0133 81 64      A      CMFA  #100
00206P 0135 2D 0C 0143    BLT  TQOUT      NO - THEN DONT SET FLAG YE
00207P 0137 86 01      A      LDAA  #1
00208P 0139 97 0F      B      STAA  TQLFQW     SET TORQUE LOW FLAG
00209P 013B 20 06 0143    BRA  TQOUT
00210P 013D 7F 000F B TQHIGH CLR  TQLFQW     CLEAR TORQUE LOW FLAG
00211P 0140 7F 001B B      CLR  TQTIME     CLEAR CONDITION TRUE TIMER
00212P 0143 01      TQOUT  NOP
00213
00214                *** CHECK FOR LANDING ****
00215P 0144 7D 0000 A      TST  CT
00216P 0147 26 2A 0173    BNE  FINA
00217P 0149 B6 0000 A      LDAA  KNOTS      GET AIR SPEED
00218P 014C 81 28      A      CMFA  #40
00219P 014E 2C 11 0161    BGE  FLUNK     BRANCH IF A/S >40
00220P 0150 7D 000E B      TST  TQDROP     TORQUE FLAG SET?
00221P 0153 27 0C 0161    BEQ  FLUNK     NO,BRANCH
00222P 0155 7D 0008 B      TST  SFROLL     ROLL FLAG SET?
00223P 0158 27 07 0161    BEQ  FLUNK     NO,BRANCH
00224P 015A 7D 000C B      TST  SFNZ      NZ FLAG SET?
00225P 015D 27 02 0161    BEQ  FLUNK     NO,BRANCH
00226P 015F 20 0A 016B    BRA  SET
00227P 0161 7D 000D B FLUNK TST  ASLFQW     LONG TIME A/S FLAG SET?
00228P 0164 27 0D 0173    BEQ  FINA     NO,BRANCH
00229P 0166 7D 000F B      TST  TQLFQW     LONG TIME TORQUE FLAG SET?
00230P 0169 27 08 0173    BEQ  FINA     NO,BRANCH
00231P 016B 86 01      A SET  LDAA  #1
00232P 016D 7F 0000 A      CLR  CGW

```

PAGE 005 S101 TAKEOFF AND LANDING DETECTION 3/10/80

00233P 0170 B7 0000 A STAA CT SET GROUND FLAG
00234P 0173 01 FINA NOP
00235 END
TOTAL ERRORS 00000

F 0122 ASHIGH 00184 00192*
B 000D ASLFQW 00022*00190 00192 00227
F 0128 ASQUT 00188 00191 00194*
B 001A ASTIME 00026*00185 00186 00193
R CGW 00007*00081 00232
R CNVTAB 00006*00045 00048 00055 00066 00104 00127 00151
R CQ 00006*00053 00201
R CRPM 00007*00037
R CT 00006*00035 00078 00095 00125 00215 00233
F 0173 FINA 00216 00228 00230 00234*
F 006D FINI 00036 00039 00054 00076 00084*
F 0161 FLUNK 00219 00221 00223 00225 00227*
R GROSWT 00007*00083
B 0000 GSAMP 00009*00043 00052 00079
F 0094 HISLOP 00115 00119*
F 005D INAIR 00042 00065 00077*
R KNOTS 00006*00040 00182 00217
B 000A NLMAX 00019*00154 00156 00158 00162
B 000B NLMIN 00020*00155 00159 00161 00163
B 0009 NTIM 00018*00152 00166 00169 00170
B 0003 NZMAX 00012*00049 00067 00069 00073
B 0004 NZMIN 00013*00050 00070 00072 00074
B 0006 RLMAX 00015*00130 00132 00134 00138
B 0007 RLMIN 00016*00131 00135 00137 00139
B 0001 RMAX 00010*00046 00056 00058 00062
B 0002 RMIN 00011*00047 00059 00061 00063
F 00AD RS1 00129 00132*
F 010B RS10 00126 00168 00172 00175*
F 00B3 RS2 00133 00135*
F 00B9 RS3 00136 00138*
F 00C9 RS4 00141 00145*
F 00D6 RS5 00144 00148 00151*
F 00E2 RS6 00153 00156*
F 00E8 RS7 00157 00159*
F 00EE RS8 00160 00162*
F 00FE RS9 00165 00169*
B 0005 RTIM 00014*00128 00142 00145 00146
F 016B SET 00226 00231*
B 000C SFNZ 00021*00167 00174 00224
B 0008 SFROLL 00017*00143 00150 00222
F 002A SKIP 00044 00053*
F 0038 SKIP2 00057 00059*
F 003E SKIP3 00060 00062*
F 004F SKIP4 00068 00070*
F 0055 SKIP5 00071 00073*
F 009B TDOUT 00096 00118 00120 00122*
B 0010 TDTBLE 00025*00097 00109
B 000E TQDROP 00023*00116 00117 00121 00220
F 013D TQHIGH 00202 00210*
B 000F TQLFQW 00024*00208 00210 00229
F 0078 TQLQOP 00099*00103

PAGE 006 ST01 TAKEOFF AND LANDING DETECTION 3/10/80

F 0143 TQOUT 00206 00209 00212*
B 001B TQTIME 00027*00203 00204 00211

PAGE 001 CDRTS CALCULATE CLIMB DESCENT (400FPM) AH1S 11/4/78

00001 NAM CDRTS
 00002 TTL CALCULATE CLIMB DESCENT (400FPM) AH
 00003 OPT REL,NOG,CREF

00005 *****
 00006 * CALCULATE WHETHER RATE OF CLIMB OR DESCENT *
 00007 * EXCEED 400 FPM. *
 00008 * SET CRD TO LEVEL, DESCENT OR CLIMB *
 00009 * FIRST 30 SECONDS ALWAYS LEVEL *
 00010 * TABLES FOR A/S & ALT CONVERSION *
 00011 * SET CRD TO LEVEL, CLIMB OR DIVE *
 00012 * POWER ON TIMER *
 00013 *****

00015 XDEF ASTABL,ALTABL
 00016 XREF PSCT:SHIFT,BUMP
 00017 XREF BSCT:CROL,CQ,CNZ,CVH,CGW,C1
 00018 XREF BSCT:ALTFT,SHFTCT,KNOTS
 00019 XREF BSCT:ZERO,CRD,PWONTH,DVTABL

00021B 0000 BSCT
 00022B 0000 0001 A AVGDVH RMB 1
 00023B 0001 0001 A AVGDVL RMB 1
 00024B 0002 0001 A AVGDVC RMB 1

00026 *NOT VALID LEVEL DESCENT CLIMB
 00027 * CRD=-1 0 1 2

PAGE 002 CDRIS CALCULATE CLIMB DESCENT (400FPM) AH15 11/4/78

```

00029 *****
00030 *      GET 3.2 SECOND ALTITUDE AVERAGE      *
00031 *      LOAD DIVE TABLE FOR TIME 0          *
00032 *****

00034P 0000                                PSCT

00036P 0000 DE 00      A      LDX      ZERO
00037P 0002 86 FF      A      LDAA     #-1
00038P 0004 97 00      A      STAA     CRD      INITIALIZE CRD
00039P 0006 96 00      A      LDAA     CROL
00040P 0008 2B 02 000C  BMI      SK5      BR IF ROLL < 10
00041P 000A 6C 04      A      INC      DVTABL+4,X
00042P 000C 96 00      A SK5    LDAA     CQ
00043P 000E 2E 02 0012  BGT      SK6      BR IF TQ > 20
00044P 0010 6C 05      A      INC      DVTABL+5,X
00045P 0012 96 00      A SK6    LDAA     CNZ
00046P 0014 80 03      A      SUBA     #3
00047P 0016 2B 02 001A  BMI      ADDALT   BR IF NZ < 1.3
00048P 0018 6C 02      A      INC      DVTABL+2,X

00050P 001A D6 00      A ADDALT LDAB     ALTFT
00051P 001C DB 01      B      ADDB     AVGDVL
00052P 001E D7 01      B      STAB     AVGDVL
00053P 0020 24 02 0024  BCC      SK4
00054P 0022 6C 00      B      INC      AVGDVH,X
00055P 0024 6A 02      B SK4    DEC      AVGDVC,X
00056P 0026 2B 03 002B  BMI      FIFTY   BR IF 32 INPUTS
00057P 0028 7E 00EE P   JMP
00058P 002B 86 1F      A FIFTY LDAA     #31
00059P 002D 97 02      B      STAA     AVGDVC   RELOAD 32 COUNTER
00060P 002F 86 05      A      LDAA     #5
00061P 0031 97 00      A      STAA     SHFTCT   READY FOR 5 SHIFTS
00062P 0033 96 00      B      LDAA     AVGDVH
00063P 0035 D6 01      B      LDAB     AVGDVL
00064P 0037 BD 0000    A      JSR      SHIFT   DIVIDE BY 32
00065P 003A D7 07      A      STAB     DVTABL+7 STORE ALTAVG IN DIVE TABLE
00066P 003C 5F
00067P 003D D7 01      B      STAB     AVGDVL
00068P 003F D7 00      B      STAB     AVGDVH
00069P 0041 D6 00      A      LDAB     CVH
00070P 0043 D7 06      A      STAB     DVTABL+6
00071P 0045 D6 00      A      LDAB     KNOTS
00072P 0047 D7 08      A      STAB     DVTABL+8

00074P 0049 96 00      A      LDAA     PWONTH *****
00075P 004B 81 06      A      CMFA     #6      *DON'T ALLOW DIVE OR CLIMB
00076P 004D 24 05 0054  BCC      SETDD   * FOR FIRST 30 SECONDS
00077P 004F 4C          A      INCA     *      AFTER POWER ON
00078P 0050 97 00      A      STAA     PWONTH *****
00079P 0052 20 5C 00B0  BRA      LEVEL

```

PAGE 003 CDRTS CALCULATE CLIMB DESCENT (400FPM) AH1S 11/4/78

```

00081 *****
00082 * SET DESCENT DELTA IF *
00083 * ALT(-30) - ALT(0) > 1 *
00084 *****

00086F 0054 CE 0000 A SETDD LDX #DUTABL
00087F 0057 6F 00 A CLR 0,X
00088F 0059 6F 01 A CLR 1,X
00089F 005B E6 07 A LDAB 7,X ALT(0)
00090F 005D CB 02 A ADDB #2
00091F 005F A6 3D A LDAA 61,X ALT(-30)
00092F 0061 10 SBA ALT(-30) - [ALT(0) + 2]
00093F 0062 25 04 0068 BCS SETCLM BR IF ALT DID NOT DECREASE
00094 * BY 2 CNTS IN LAST 30 SEC
00095F 0064 6C 00 A INC 0,X
00096F 0066 20 0B 0073 BRA CHK9D

00098 *****
00099 * SET CLIMB DELTA IF *
00100 * ALT(0) - ALT(-30) > 1 *
00101 *****

00103F 0068 E6 3D A SETCLM LDAB 61,X ALT(-30)
00104F 006A CB 02 A ADDB #2
00105F 006C A6 07 A LDAA 7,X ALT(0)
00106F 006E 10 SBA ALT(0) - [ALT(-30) + 2]
00107F 006F 25 02 0073 BCS CHK9D BR IF ALT DID NOT INCREASE
00108 * BY 2 CNTS IN LAST 30 SEC
00109F 0071 6C 01 A INC 1,X

```

10
F

PAGE 004 CRTS CALCULATE CLIMB DESCENT (400FPM) AH1S 11/4/78

```

00111 *****
00112 * CHECK ALT(-45) SECONDS *
00113 *****

00115P 0073 E6 07 A CHK9D LDAB 7,X ALT(0)
00116P 0075 CB 03 A ADDB #3
00117P 0077 A6 43 A LDAA 67,X ALT(-45)
00118P 0079 10 SBA ALT(-45) - [ALT(0) + 3]
00119P 007A 24 12 008E BCC CKDSUM BR IF ALT DECREASED
00120 * BY 3 CNTS IN LAST 45 SEC

00122P 007C E6 43 A LDAB 67,X ALT(-45)
00123P 007E CB 03 A ADDB #3
00124P 0080 A6 07 A LDAA 7,X ALT(0)
00125P 0082 10 SBA ALT(0) - [ALT(-45) + 3]
00126P 0083 25 2B 00B0 BCS LEVEL BR IF ALT DID NOT INCREASE
00127 * BY 3 CNTS IN LAST 45 SEC

00129 *****
00130 * CHECK SUM OF DELTAS *
00131 *****

00133P 0085 08 INX
00134P 0086 8D 0E 0096 BSR SUMDEL
00135P 0088 C1 05 A CMPB #5
00136P 008A 25 24 00B0 BCS LEVEL BR IF SUM OF CLM DEL < 5
00137P 008C 20 1C 00AA BRA CLIMB1

00139P 008E 8D 06 0096 CKDSUM BSR SUMDEL
00140P 0090 C1 05 A CMPB #5
00141P 0092 25 1C 00B0 BCS LEVEL BR IF SUM OF DIVE DEL < 5
00142P 0094 20 17 00AD BRA DESEND

00144 *****
00145 * SUMDEL *
00146 * SUBROUTINE *
00147 *****

00149P 0096 5F SUMDEL CLRB
00150P 0097 86 09 A LP5 LDAA #9
00151P 0099 EB 00 A ADDB 0,X
00152P 009B 08 LP6 INX
00153P 009C 4A DECA
00154P 009D 26 FC 009B BNE LP6
00155P 009F 8C 003F A CPX #DVTABL+63
00156P 00A2 27 05 00A9 BEQ OUTSUM
00157P 00A4 8C 0040 A CPX #DVTABL+64
00158P 00A7 26 EE 0097 BNE LP5
00159P 00A9 39 OUTSUM RTS

00161P 00AA 7C 0000 A CLIMB1 INC CRD
00162P 00AD 7C 0000 A DESEND INC CRD
00163P 00B0 7C 0000 A LEVEL INC CRD

00165P 00B3 20 39 00EE BRA GO+3

```

10
B

PAGE 005 CDRTS CALCULATE CLIMB DESCENT (400FFM) AH1S 11/4/78

00167F	00B5	FC	A	ALTABL	FCB	252,255,0
00168F	00B8	E5	A		FCB	229,225,44
00169F	00BB	C7	A		FCB	199,187,40
00170F	00BE	9C	A		FCB	156,138,36
00171F	00C1	7C	A		FCB	124,105,34
00172F	00C4	5A	A		FCB	90,74,30
00173F	00C7	40	A		FCB	64,51,29
00174F	00CA	25	A		FCB	37,29,26
00175F	00CD	00	A		FCB	0,0,25
00176F	00D0	FA	A	ASTABL	FCB	250,202,0
00177F	00D3	B0	A		FCB	176,171,14
00178F	00D6	70	A		FCB	112,137,17
00179F	00D9	50	A		FCB	80,116,21
00180F	00DC	32	A		FCB	50,92,26
00181F	00DF	1E	A		FCB	30,71,32
00182F	00E2	15	A		FCB	21,59,47
00183F	00E5	0C	A		FCB	12,45,54
00184F	00E8	05	A		FCB	5,29,77
00185F	00EB	00	A	GO	FCB	0,0,186
00186					END	

TOTAL ERRORS 00000

P 001A ADDALT 00047 00050*

DP 00B5 ALTABL 00015 00167*

RB ALTFT 00018*00050

DP 00D0 ASTABL 00015 00176*

B 0002 AVGDVC 00024*00055 00059

B 0000 AVGDVH 00022*00054 00062 00068

B 0001 AVGDVL 00023*00051 00052 00063 00067

RP BUMF 00016*

RB C1 00017*

RB CGW 00017*

P 0073 CHK9D 00096 00107 00115*

P 008E CKDSUM 00119 00139*

P 00AA CLIMB1 00137 00161*

RB CNZ 00017*00045

RB CQ 00017*00042

RB CRD 00019*00038 00161 00162 00163

RB CROL 00017*00039

RB CVH 00017*00069

P 00AD DESEND 00142 00162*

RB DVTABL 00019*00041 00044 00048 00065 00070 00072 00086 00155

00157

P 002B FIFTY 00056 00058*

P 00EB GO 00057 00165 00185*

RB KNOTS 00018*00071

P 00B0 LEVEL 00079 00126 00136 00141 00163*

P 0097 LP5 00150*00158

P 009B LP6 00152*00154

P 00A9 OUTSUM 00156 00159*

RB PWONTH 00019*00074 00078

P 0068 SETCLM 00093 00103*

P 0054 SETDD 00076 00086*

RB SHFTCT 00018*00061

RP SHIFT 00016*00064

P 0024 SK4 00053 00055*

PAGE 006 CDRTS CALCULATE CLIMB DESCENT (400FPM) AH1S 11/4/78

F 000C SK5 00040 00042*
F 0012 SK6 00043 00045*
F 0096 SUMDEL 00134 00139 00149*
RB ZERO 00019*00036

PAGE 001 LNDGS2 LANDINGS/GND&AUTO TIME VERSION 2 26/1/78

```

00001          NAM      LNDGS2A
00002          TTL      LANDINGS/GND&AUTO TIME VERSION 2 26
00003          OPT      REL,CREF
00004          *****
00005          *      BUMP TORQUE TABLE ONCE PER SECOND      *
00006          *      FCTOLD NORMAL LANDINGS(NO GW)          *
00007          *      FCAULD AUTOROTATIVE LANDINGS(NO GW)     *
00008          *      FCGNTH GROUND TIME(NO GW)               *
00009          *      FCAUTH AUTO ROTATIVE FLIGHT TIME(BY GW)  *
00010          *****

```

```

00012          XREF      DSCT:FCAUTH,FCGNTH,FCTOLD,FCAULD
00013          XREF      PSCT:BUMP,BUMPN,QTABLE
00014          XREF      BSCT:CRPM,C1,T23,CT,ZERO
00015          XREF      BSCT:CNVTAB,CQ
00016          XREF      BSCT:FTIME2,EXPTR,FTIME
00017          XREF      ANY:RUDSLPL,GROSWT

```

```

00019B 0000          BSCT
00020B 0000          0001 A GTM      RMB      1
00021B 0001          0001 A AIRTIM  RMB      1
00022B 0002          0001 A AIR      RMB      1
00023B 0003          000F A          RMB     15
00024B 0012          0001 A TRQ      RMB      1
00025B 0013          0001 A T1       RMB      1

```

PAGE 002 LNDGS2 LANDINGS/GND&AUTO TIME VERSION 2 26/1/78

```

00027F 0000          PSCT
00028          *****
00029          *      BUMP TORQUE TABLE      *
00030          *****
00031F 0000 DE 00    A      LDX      ZERO
00032F 0002 96 13    B      LDAA     T1
00033F 0004 4C          INCA
00034F 0005 97 13    B      STAA     T1
00035F 0007 81 14    A      CMPA     #20      2 SEC ?
00036F 0009 26 13 001E  BNE      FB
00037F 000B 6F 13    B      CLR      T1,X
00038F 000D 96 04    A      LDAA     CNVTAB+4 CORRECTED TORQUE
00039F 000F 97 12    B      STAA     TRQ
00040F 0011 CE 0003  B      LDX      #TRQ-15
00041F 0014 C6 0F    A      LDAB     #15
00042F 0016 A6 01    A      LDAA     1,X
00043F 0018 A7 00    A      STAA     0,X
00044F 001A 08          INX
00045F 001B 5A          DECH
00046F 001C 26 FB 0016  BNE      BMF

00048          *****
00049          *      LANDINGS FLT COND'S      *
00050          *****
00051F 001E DE 00    A      FB      LDX      ZERO
00052F 0020 6D 00    A      TST      CT,X      A/C ON GROUND?
00053F 0022 27 49 006D  BEQ      FBJ      NO,BR
00054F 0024 A6 00    B      LDAA     GTM,X      GROUND TIMER
00055F 0026 81 32    A      CMPA     #50      GND TIMER = 5 SEC?
00056F 0028 26 3F 0069  BNE      FBH      NO,BR
00057F 002A 6D 02    B      TST      AIR,X      AIR SET?
00058F 002C 27 35 0063  BEQ      FBH      NO,BR
00059F 002E CE 0003  B      LDX      #TRQ-15
00060F 0031 4F          CLRA
00061F 0032 F6 0001  A      LDAB     QTABLE+1 TRQ 20 PSI THRESHOLD
00062F 0035 E1 00    A      FBA      CMPB     0,X      TQ => 20 PSI THRESHOLD ?
00063F 0037 25 01 003A  BCS      FBB      YES,BR
00064F 0039 4C          INCA
00065F 003A 08          FBB      INX
00066F 003B 8C 000E  B      CPX      #TRQ-4      LOOP DONE ?
00067F 003E 26 F5 0035  BNE      FBA      NO,BR
00068F 0040 CE 0000  A      LDX      #FCTOLD      POINT TO NORMAL LDGS
00069F 0043 81 06    A      CMPA     #6      AVG TRQ MED OR HIGH ?
00070F 0045 25 03 004A  BCS      FBE      YES,BR
00071F 0047 CE 0000  A      FBD      LDX      #FCAULD      AUTOROTATIVE LANDING
00072F 004A 86 00    A      FBE      LDAA     #C1      CONSTANT "1"
00073F 004C 5F          CLR      NO GROSS WEIGHT
00074F 004D BD 0000  A      JSR      BUMPN      COUNT LANDING
00075F 0050 DE 00    A      LDX      EXPTR
00076F 0052 B6 0000  A      LDAA     GROSSWT
00077F 0055 A7 04    A      STAA     4,X      STORE LD GW
00078F 0057 96 00    A      LDAA     FTIME
00079F 0059 A7 05    A      STAA     5,X      STORE FLIGHT TIME
00080F 005B DE 00    A      LDX      ZERO
00081F 005D DF 00    A      STX      EXPTR      CLEAR ALL "EXTRA
00082F 005F DF 00    A      STX      FTIME      DATA" SCRATCHPAD
00083F 0061 DF 01    A      STX      FTIME2+1 LOCATIONS

```

PAGE 003 LNDGS2 LANDINGS/GND&AUTO TIME VERSION 2 26/1/78

```

00085F 0063 6F 02      B FBF      CLR      AIR,X      SET GROUND
00086F 0065 6F 01      B          CLR      AIRTIM,X CLR AIRTIME
00087F 0067 20 2E 0097      BRA      GROUND      EXIT
00088F 0069 6C 00      B FBH      INC      GTM,X      BUMP GROUND TIME
00089F 006B 20 2A 0097      BRA      GROUND      EXIT
00090F 006D A6 01      B FBJ      LDAA     AIRTIM,X AIR TIME
00091F 006F 81 64      A          CMFA     #100     AIRBORNE FOR 10 SEC?
00092F 0071 27 04 0077      BEQ      F8K      YES,BR
00093F 0073 6C 01      B          INC      AIRTIM,X BUMP AIRTIME
00094F 0075 20 20 0097      BRA      GROUND
00095F 0077 6F 00      B F8K      CLR      GTM,X      CLEAR GROUND TIMER
00096F 0079 6D 02      B          TST      AIR,X      AIR FLAG ALREADY SET ?
00097F 007B 26 39 00B6      BNE      AUTH      YES,BR
00098F 007D 86 01      A          LDAA     #1
00099F 007F A7 02      B          STAA     AIR,X      SET AIR

```

```

00101                                *          SET EXTRA DATA POINTER
00102F 0081 CE 0001 A          *          LDX      #RUDSLP+1 ONCE PER FLIGHT
00103F 0084 86 06      A LOOP    LDAA     #6
00104F 0086 6D 00      A          TST      0,X
00105F 0088 27 0B 0095      BEQ      GETEXX
00106F 008A 08          LP1      INX
00107F 008B 8C 07F5 A          CFX      #7F5
00108F 008E 27 05 0095      BEQ      GETEXX
00109F 0090 4A          DECA
00110F 0091 26 F7 008A      BNE      LP1
00111F 0093 20 EF 0084      BRA      LOOP
00112F 0095 DF 00      A GETEXX STX      EXPTR

```

```

00114                                *****
00115                                *          FCGNTM GROUND TIME          *
00116                                *****

```

```

00118F 0097 96 00      A GROUND LDAA     CT          AIRBORNE ?
00119F 0099 27 1B 00B6      BEQ      AUTH      YES,BR
00120F 009B 96 00      A          LDAA     CRPM
00121F 009D 81 FC      A          CMFA     #-4          RPM < 250 ?
00122F 009F 27 21 00C2      BEQ      GO+3      YES,BR
00123F 00A1 CE 0000 A          LDX      #FCGNTM
00124F 00A4 86 00      A          LDAA     #C1
00125F 00A6 5F          CLRB
00126F 00A7 BD 0000 A          JSR      BUMFN      NO GW
00127F 00AA CE 0000 A          LDX      #T23      HIGHEST GND CLEARED LOC
00128F 00AD E7 00      A LPCL    STAB     0,X
00129F 00AF 09          DEX
00130F 00B0 26 FB 00AD      BNE      LPCL
00131F 00B2 D7 00      A          STAB     0
00132F 00B4 20 0C 00C2      BRA      GO+3

```

```

00134                                *****
00135                                *          AUTOROTATIVE FLIGHT TIME          *
00136                                *****

```

```

00138F 00B6 96 00      A AUTH     LDAA     CQ          TORQUE < 10 PSI ?
00139F 00B8 2A 0B 00C2      BPL      GO+3      NO,BR
00140F 00BA 86 00      A          LDAA     #C1          CONSTANT "1"
00141F 00BC CE 0000 A          LDX      #FCAUTH
00142F 00BF BD 0000 A GO      JSR      BUMF

```


PAGE 004 LNDG52 LANDINGS/GND&AUTO TIME VERSION 2 26/1/78

00143
TOTAL ERRORS 00000

END

B 0002 AIR 00022*00057 00085 00096 00099
B 0001 AIRTIM 00021*00086 00090 00093
P 00B6 AUTM 00097 00119 00138*
P 0016 BMP 00042*00046
RP BUMP 00013*00142
RP BUMPN 00013*00074 00126
RB C1 00014*00072 00124 00140
RB CNVTAB 00015*00038
RB CQ 00015*00138
RB CRPM 00014*00120
RB CT 00014*00052 00118
RB EXPTR 00016*00075 00081 00112
P 001E FB 00036 00051*
P 0035 FBA 00062*00067
P 003A FBB 00063 00065*
P 0047 FBD 00071*
P 004A FBE 00070 00072*
P 0063 FBF 00058 00085*
P 0069 FBH 00056 00088*
P 006D FBJ 00053 00090*
P 0077 FBK 00092 00095*
RD FCAULD 00012*00071
RD FCAUTM 00012*00141
RD FCGNTM 00012*00123
RD FCTOLD 00012*00068
RB FTIME 00016*00078 00082
RB FTIME2 00016*00083
P 0095 GETEXX 00105 00108 00112*
P 00BF GO 00122 00132 00139 00142*
R GROSWT 00017*00076
P 0097 GROUND 00087 00089 00094 00118*
B 0000 GTM 00020*00054 00088 00095
P 00B4 LOOP 00103*00111
P 00BA LP1 00106*00110
P 00AD LPCL 00128*00130
RP QTABLE 00013*00061
R RUDSLP 00017*00102
B 0013 T1 00025*00032 00034 00037
RB T23 00014*00127
B 0012 TRQ 00024*00039 00040 00059 00066
RB ZERO 00014*00031 00051 00080

PAGE 001 BRPMC ROTOR CYCLES AHIS 11/4/78

00001	NAM	BRPMC
00002	TTL	ROTOR CYCLES AHIS 11/4/78
00003	OPT	CREF,REL

00005	*****
00006	* SET CONSTANT 1 *
00007	* GO BUMP/WAIT IF POWER ON 6 SECONDS *
00008	* ROTOR CYCLES FCRPMC *
00009	*****

00011	XDEF	C1
-------	------	----

00013	XREF	PSCT:BUMFN,ENTER
00014	XREF	ANY:ARM,FCRPMC
00015	XREF	BSCT:CRPM,ZERO,FWONTH

00017B 0000	BSCT	
00018B 0000	RMB	3

0003 A C1

PAGE 002 BRPMC ROTOR CYCLES AHIS 11/4/78

00020F 0000

PSCT

00022 *****
00023 * SET CONSTANT 1 *
00024 *****

00026F 0000 DE 00 A ANALYZ LDX ZERO
00027F 0002 EF 00 B STX C1,X DEFINE CONSTANT 1
00028F 0004 EF 01 B STX C1+1,X FOR USE WITH
00029F 0006 6C 00 B INC C1,X FOUR GW RANGES

00031 *****
00032 * POWER ON DELAY *
00033 *****

00035F 0008 96 00 A LDAA PWONTH
00036F 000A 81 02 A CMPA #2 POWER ON OVER 6.4 SEC ?
00037F 000C 24 03 0011 BCC START YES BR
00038F 000E 7E 0000 A JMP BENTER

00040 *****
00041 * ROTOR CYCLES *
00042 *****

00044F 0011 96 00 A START LDAA CRPM
00045F 0013 7D 0000 A TST ARM IS ARM SET ? (-1)
00046F 0016 27 12 002A BEQ LAB1 NO, BRANCH
00047F 0018 81 FC A CMPA #-4 RPM<250 ? (-2)
00048F 001A 26 15 0031 BNE GO+3 NO, BRANCH
00049F 001C CE 0000 A LDX #FCRPMC POINT TO ROTOR STARTS
00050F 001F 86 00 B LDAA #C1 ADD 1
00051F 0021 5F CLR B CLR B NO GW
00052F 0022 BD 0000 A JSR BUMPN BUMP FCC
00053F 0025 7F 0000 A CLR ARM RESET ARM (0)
00054F 0028 20 07 0031 BRA GO+3 GO TO FLARE

00056F 002A 81 FE A LAB1 CMPA #-2 RPM > 314 ?
00057F 002C 2D 03 0031 BLT GO+3 NO, BRANCH
00058F 002E 73 0000 A GO COM ARM SET ARM (-1)
00059 END
TOTAL ERRORS 00000

P 0000 ANALYZ 00026*
R ARM 00014*00045 00053 00058
RP BENTER 00013*00038
RP BUMPN 00013*00052
DB 0000 C1 00011 00018*00027 00028 00029 00050
RB CRPM 00015*00044
R FCRPMC 00014*00049
P 002E GO 00048 00054 00057 00058*
P 002A LAB1 00046 00056*
RB PWONTH 00015*00035
P 0011 START 00037 00044*
RB ZERO 00015*00026

PAGE 001 BFLAR **FLARE FLT COND 6 DEC 77**

00001	NAM	BFLAR
00002	OFT	REL,NOG,CREF
00003	TTL	**FLARE FLT COND 6 DEC 77**

00005	*****
00006	* FLARE FCC *
00007	*****

00009	XREF	PSCT:BUMP,BENTER
00010	XREF	ANY:FCFLAR
00011	XREF	BSCT:CRD,CQ,CVH
00012	XREF	BSCT:C1,CGW,CT

00014B 0000			BSCT	
00015B 0000	0001	A DFLG	RMB	1
00016B 0001	0001	A FLTM	RMB	1

PAGE 003 BFLAR **FLARE FLT COND 6 DEC 77**

RB C1 00012*00053
RB CGW 00012*
P 0035 CLRGO 00038 00051 00055*00061
RB CQ 00011*00029
RB CRD 00011*00025 00039
RB CT 00012*00048 00066
RB CVH 00011*00036
B 0000 DFLG 00015*00042 00050 00055
R FCFLAR 00010*00052
P 0010 FL1 00028 00034*
P 0018 FL1A 00039*00047
P 0021 FL2 00035 00045*
P 0025 FL4 00048*
P 0029 FL4A 00050*00063
P 0039 FL7 00049 00058*
P 0000 FLARE 00025*
B 0001 FLTM 00016*00027 00031
P 004A GO 00067 00068*
P 000E GOGND 00026 00030 00032*
P 000C INCGO 00031*00041 00043 00059 00064
P 0046 TSTGND 00032 00056 00066*

PAGE 003 BFLAR **FLARE FLT COND 6 DEC 77**

RB C1 00012*00053
RB CGW 00012*
F 0035 CLRGO 00038 00051 00055*00061
RB CR 00011*00029
RB CRD 00011*00025 00039
RB CT 00012*00048 00066
RB CVH 00011*00036
B 0000 DFLG 00015*00042 00050 00055
R FCFLAR 00010*00052
P 0010 FL1 00028 00034*
P 0018 FL1A 00039*00047
P 0021 FL2 00035 00045*
P 0025 FL4 00048*
P 0029 FL4A 00050*00043
P 0039 FL7 00049 00058*
P 0000 FLARE 00025*
B 0001 FLTM 00016*00027 00031
P 004A GD 00067 00068*
P 000E GOGND 00026 00030 00032*
P 000C INCGO 00031*00041 00043 00059 00064
P 0046 TSTGND 00032 00056 00066*

PAGE 001 TRIVAR TRIVARIENT TABLE RUDDER+A/S+TORQUE AH1S 11/4/78

00001 NAM TRIVAR
00002 OPT REL,CREF
00003 TTL TRIVARIENT TABLE RUDDER+A/S+TORQUE

00005 *****
00006 * SET CRUD *
00007 * BUMP TRIVARIENT TABLE FCTVR *
00008 * ONCE PER SECOND *
00009 *****

*RUDDER	A/S	TORQUE	BYTES
*(%)	(VH)	(PSI)	(+FCTVR)

* 0-10	<.5	<10	0,1
* "	"	10-20	2,3
* "	"	20-30	4,5
* "	"	30-40	6,7
* "	"	40-50	8,9
* "	"	>50	10,11

* "	.5-.7	(6)	12-23

* "	.7-.9	(6)	24-35

* "	>.9	(6)	36-47

*10-20	(4)	(6)	48-95

*20-40	(4)	(6)	96-143

*40-60	(4)	(6)	144-191

*60-80	(4)	(6)	192-239

*80-90	(4)	(6)	240-287

*90-100	(4)	(6)	288-335

* %	-----							
*RUDDER	0-10	10-20	20-40	40-60	60-80	80-90	>90%	
*CRUD	0	1	2	3	4	5	6	

00045 XREF ANY:FCTVR,RUDINT,RUDSLP
00046 XREF PSCT:BUMP,XCER
00047 XREF BSCT:CQ,ZERO,CVH,CNVTAB,C1
00048 XREF BSCT:CNT,CRUD,NUM

00050 0028 A PSI10 EQU 40

00052B 0000 BSCT

00053B 0000 0002 A TRIPTR RMB 2

00054B 0002 0001 A CNT1 RMB 1

PAGE 002 TRIVAR TRIVARIENT TABLE RUDDER+A/S+TORQUE AH15 11/4/78

```

00056 *****
00057 *      BUMP TABLE ONLY      *
00058 *      ONCE PER SECOND      *
00059 *****

```

00061P 0000 PSCT

```

00063P 0000 96 02 B LDAA CNT1
00064P 0002 4C INCA
00065P 0003 81 0A A CMPA #10
00066P 0005 27 04 000B BEQ STCRUD
00067P 0007 97 02 B STAA CNT1
00068P 0009 20 6B 0076 BRA GO+3

```

```

00070 *****
00071 *      SET CRUD      *
00072 *****

```

```

00074P 000B B6 0000 A STCRUD LDAA RUDINT
00075P 000E 97 00 A STAA NUM
00076P 0010 D6 03 A LDAB CNVTAB+3 RUDDER CONVERSION
00077P 0012 B6 0000 A LDAA RUBSLP
00078P 0015 BD 0000 A JSR XCER CORRECTED RUDDER RTN'D IN

```

```

00080P 0018 6F 02 B CLR CNT1,X
00081P 001A C6 06 A LDAB #6
00082P 001C D7 00 A STAB CRUD INITILIZE CRUD
00083P 001E CE 002B F LDX #RUDTBL
00084P 0021 A1 00 A LP CMPA 0,X 90%,80,60,40,20,10,0
00085P 0023 24 18 003D BCC SETPTR
00086P 0025 08 INX
00087P 0026 7A 0000 A DEC CRUD
00088P 0029 20 F6 0021 BRA LP

```

```

00090P 002B B4 A RUDTBL FCB 180,160,120,80,40,20,0
P 002C A0 A
P 002D 78 A
P 002E 50 A
P 002F 28 A
P 0030 14 A
P 0031 00 A

```


PAGE 003 TRIVAR TRIVARIENT TABLE RUDDER+A/S+TORQUE AH1S 11/4/78

```
00092 *****
00093 *      BUMP POINTER      *
00094 *      SUBROUTINE       *
00095 *****
```

```
00097P 0032 36      BMPTR PSHA
00098P 0033 9B 01    B      ADDA   TRIPTR+1
00099P 0035 97 01    B      STAA   TRIPTR+1
00100P 0037 24 02 003B BCC      EX
00101P 0039 6C 00    B      INC    TRIPTR,X
00102P 003B 32      EX      PULA
00103P 003C 39      RTS
```

```
00105 *****
00106 *      CALCULATE TABLE POINTER      *
00107 *****
```

```
00109P 003D CE 0000  A SETPTR LDX      #FCTRVR  TABLE START LOCATION
00110P 0040 DF 00    B      STX      TRIPTR
00111P 0042 DE 00    A      LDX      ZERO
00112P 0044 86 30    A      LDAA     #48
00113P 0046 6D 00    A LP1      TST      CRUD,X
00114P 0048 27 06 0050      BEQ      VHNXT
00115P 004A 8D E6 0032      BSR      BMPTR
00116P 004C 6A 00    A      DEC      CRUD,X
00117P 004E 20 F6 0046      BRA      LP1

00119P 0050 86 0C    A VHNXT  LDAA     #12
00120P 0052 C6 03    A      LDAB     #3
00121P 0054 D7 00    A      STAB     CNT
00122P 0056 D6 00    A      LDAB     CVH
00123P 0058 5D      LP2      TSTB
00124P 0059 2B 08 0063      BMI      TQNXT
00125P 005B 8D D5 0032      BSR      BMPTR
00126P 005D 5A      DECB
00127P 005E 5A      DECB
00128P 005F 6A 00    A      DEC      CNT,X
00129P 0061 26 F5 005B      BNE      LP2

00131P 0063 86 02    A TQNXT  LDAA     #2
00132P 0065 D6 00    A      LDAB     CQ
00133P 0067 2B 05 006E LP3      BMI      TRIFCC
00134P 0069 8D C7 0032      BSR      BMPTR
00135P 006B 5A      DECB
00136P 006C 20 F9 0067      BRA      LP3
```

```
00138 *****
00139 *      ADD 1 TO TABLE      *
00140 *****
```

```
00142P 006E DE 00    B TRIFCC LDX      TRIPTR
00143P 0070 5F      CLRB
00144P 0071 86 00    A      LDAA     #C1
00145P 0073 BD 0000  A GO      JSR      BUMPFN
00146P 0076 7E C000  A      JMP      $C000      FROM BREAKS HERE
```

```
00148      END
TOTAL ERRORS 00000
```

PAGE 004 TRIVAR TRIVARIENT TABLE RUDDER+A/S+TORQUE AH1S 11/4/78

F 0032 BMPTR 00097*00115 00125 00134
 RP BUMPN 00046*00145
 RB C1 00047*00144
 RB CNT 00048*00121 00128
 B 0002 CNT1 00054*00063 00067 00080
 RB CNVTAB 00047*00076
 RB CQ 00047*00132
 RB CRUD 00048*00082 00087 00113 00116
 RB CVH 00047*00122
 F 003B EX 00100 00102*
 R FCTVR 00045*00109
 P 0073 G0 00068 00145*
 P 0021 LP 00084*00088
 P 0046 LP1 00113*00117
 P 0058 LP2 00123*00129
 P 0067 LP3 00133*00136
 RB NUM 00048*00075
 0028 PSI10 00050*
 R RUDINT 00045*00074
 R RUDSLF 00045*00077
 P 002B RUDTBL 00083 00090*
 P 003D SETPTR 00085 00109*
 P 000B STCRUD 00066 00074*
 P 0063 TQNT 00124 00131*
 P 006E TRIFCC 00133 00142*
 B 0000 TRIFTR 00053*00098 00099 00101 00110 00142
 P 0050 VHNXT 00114 00119*
 RP XCER 00046*00078
 RB ZERO 00047*00111

11
F

PAGE 001 DVSPU DIVES+SYM PULLUPS AH1S 11/4/78

00001 NAM DVSPU
00002 TTL DIVES+SYM PULLUPS AH1S 11/4/78
00003 OPT REL,CREF

00005 *****
00006 * FCSMDV SYMMETRICAL DIVE (GW) *
00007 * FCASDV ASYMMETRICAL DIVE (GW) *
00008 * FCSMPU SYMMETRICAL PULLUP (GW) *
00009 * SET TNDVFG FOR ASSYM PULLUPS *
00010 *****

00013 XREF PSCT:BUMFN
00014 XREF ANY:FCSMDV,FCASDV,FCSMPU
00015 XREF BSCT:CROL,CQ,CNZ,CNVTAB
00016 XREF BSCT:CVL,SVL,MODE
00017 XREF BSCT:TNDVFG,T23A,T23,CGW

00019 0086 A NZ1.1 EQU 134

00021B 0000		BSCT	
00022B 0000	0001 A DVFG	RMB	1
00023B 0001	0003 A DVTM	RMB	3
00024B 0004	0001 A T2	RMB	1
00025B 0005	0001 A ALDV	RMB	1
00026B 0006	0001 A ASDV	RMB	1
00027B 0007	0001 A ASDVFG	RMB	1
00028B 0008	0001 A LOTQFG	RMB	1
00029B 0009	0001 A SPUFG	RMB	1
00030B 000A	0003 A SPUTM	RMB	3

11
B

00032F 0000

FSCT

00034F	0000	6D 00	B F7	TST	DVFG,X	DIVE FLAG SET?
00035F	0002	27 55	0059	BEQ	F7H	NO,BR
00036F	0004	6C 01	B	INC	DVTM,X	DIVE TIME = 25.6 SEC?
00037F	0006	27 4B	0053	BEQ	RSTDV	YES,BR TO RESET
00038F	0008	6D 00	A F7A	TST	CROL,X	ROLL<10
00039F	000A	2B 04	0010	BMI	F7B	YES,BR
00040F	000C	86 FF	A	LDAA	##FF	
00041F	000E	97 07	B	STAA	ASDVFG	SET ASYM DIVE FLAG
00042F	0010	6D 00	A F7B	TST	CG,X	TORQUE MED OR HIGH?
00043F	0012	2A 02	0016	BFL	F7B1	YES,BR (TQ>10PSI)
00044F	0014	97 08	B	STAA	LOTQFG	SET LO TORQUE FLAG
00045F	0016	D6 00	A F7B1	LDAB	CNZ	
00046F	0018	C1 03	A	CMFB	#3	NZ > 1.3 ?
00047F	001A	25 3B	0057	BCS	F81X	NO,BR
00048F	001C	D6 07	A	LDAB	CNVTAB+7	GET ALTITUDE
00049F	001E	CB 04	A	ADDB	#4	
00050F	0020	D1 05	B	CMFB	ALDV	ENTER ALT - EXIT ALT > 4?
00051F	0022	24 2F	0053	BCC	RSTDV	NO,BR TO RESET
00052F	0024	D6 06	B	LDAB	ASDV	GET ENTER A/S
00053F	0026	CB 0E	A	ADDB	#14	
00054F	0028	D1 10	A	CMFB	CNVTAB+16	EXIT A/S - ENTER A/S > 14
00055F	002A	24 27	0053	BCC	RSTDV	NO,BR TO RESET
00056F	002C	6D 08	B	TST	LOTQFG,X	LO TQ DURING DIVE?
00057F	002E	26 23	0053	BNE	RSTDV	YES,BR TO RESET DIVE
00058F	0030	CE 0000	A	LDX	#FCSMDV	SYM DIVES POINTER
00059F	0033	96 07	B	LDAA	ASDVFG	SYM DIVE?
00060F	0035	27 03	003A	BEQ	F7E	YES,BR
00061F	0037	CE 0000	A	LDX	#FCASDV	ASSYM DIVES POINTER
00063F	003A	86 01	B F7E	LDAA	#DVTM	POINT A AT DIVE TIMER
00064F	003C	D6 00	A	LDAB	CGW	GET GROSS WEIGHT
00065F	003E	BD 0000	A	JSR	BUMPN	
00067F	0041	96 00	A F7F	LDAA	CVL	
00068F	0043	97 00	A	STAA	SVL	SAVE PULLUP ENTRY VL
00069F	0045	6D 00	A	TST	MODE,X	TURN IN PROGRESS?
00070F	0047	27 08	0051	BEQ	F7G	NO,BR
00071F	0049	EF 00	A	STX	T23,X	CLEAR TURN TIMERS
00072F	004B	EF 00	A	STX	T23A,X	
00073F	004D	63 00	A	COM	TNDVFG,X	SET FLAG FOR TURN LOGIC
00074F	004F	20 02	0053	BRA	RSTDV	

PAGE 003 DVSPU DIVES+SYM PULLUPS AH15 11/4/78

```

00076F 0051 63 09      B F7G      COM      SPUGF,X      SET SYM PULLUP FLAG
00077F 0053 DF 00      B RSTDV     STX      DVFG      CLEAR DIVE FLAG & TIMER
00078F 0055 DF 07      B          STX      ASDVFG     CLEAR ASDV & LOTQ FLAGS
00079F 0057 20 52 00AB F81X     BRA      G0+2

00081F 0059 96 00      A F7H      LDAA      CNZ      NZ < .8 ?
00082F 005B 26 16 0073      BNE      F7K      NO,BR
00083F 005D 96 04      B          LDAA      T2      NZ<.8 TIMER
00084F 005F 81 0A      A          CMFA      #10     TIMER = 1 SEC?
00085F 0061 27 04 0067      BEQ      F7J      YES,BR
00086F 0063 6C 04      B          INC      T2,X
00087F 0065 20 0E 0075      BRA      F7K0
00088F 0067 97 00      B F7J      STAA      DVFG      SET DIVE FLAG
00089F 0069 96 07      A          LDAA      CNVTAB+7 GET ALTITUDE
00090F 006B 97 05      B          STAA      ALDV      SAVE ALT
00091F 006D 96 10      A          LDAA      CNVTAB+16 GET AIRSPEED
00092F 006F 97 06      B          STAA      ASDV      SAVE A/S
00093F 0071 20 95 000B      BRA      F7A

00095F 0073 6F 04      B F7K      CLR      T2,X      CLEAR (NZ<.8) TIMER
00096F 0075 6D 09      B F7K0     TST      SPUGF,X     SYM PULLUP FLAG SET?
00097F 0077 27 32 00AB      BEQ      G0+2      NO,BR
00098F 0079 96 00      A          LDAA      CQ      TQ MED OR HIGH?
00099F 007B 2A 02 007F      BPL      F7K1     YES,BR (TQ>10PSI)
00100F 007D 97 08      B          STAA      LOTQFG    SET LO TQ FLAG
00101F 007F 6C 0A      B F7K1     INC      SPUTM,X   OVERFLOW?
00102F 0081 26 02 0085      BNE      F7L      NO,BR
00103F 0083 6C 0B      B          INC      SPUTM+1,X
00104F 0085 96 00      A F7L      LDAA      CNZ      NZ > 1.3 ?
00105F 0087 81 03      A          CMFA      #3      NZ>1.3?
00106F 0089 24 1A 00A5      BCC      F7T      YES,BR
00107F 008B 96 06      A F7M      LDAA      CNVTAB+6 NZ CONVERSION
00108F 008D 81 86      A          CMFA      #NZ1.1  NZ > 1.1 ?
00109F 008F 24 1A 00AB      BCC      G0+2      YES,BR
00110F 0091 6D 08      B F7N      TST      LOTQFG,X   TORQUE LOW DURING PULLUP?
00111F 0093 26 0A 009F      BNE      RSTPU     YES,BR
00112F 0095 CE 0000      A          LDX      #FCSMPU  SYM PULLUP POINTER
00113F 0098 86 0A      B          LDAA      #SPUTM   POINT AT PULLUP TIMER
00114F 009A D6 00      A          LDAB      CGW      GET GROSS WEIGHT
00115F 009C BD 0000      A          JSR      BUMPN     BUMP SYM PULLUP FCC
00116F 009F DF 08      B RSTPU     STX      LOTQFG    CLEAR LOTQ, SPU FLAGS
00117F 00A1 DF 0A      B          STX      SPUTM     CLEAR SYM PULLUP TIMER
00118F 00A3 20 06 00AB      BRA      G0+2

00120F 00A5 6D 00      A F7T      TST      CROL,X     ROLL > 10 ?
00121F 00A7 2A F6 009F      BPL      RSTPU     YES,BR
00122F 00A9 20 E0 00BB      BRA      F7M
00123      END
TOTAL ERRORS 00000

```

```

B 0005 ALDV      00025*00050 00090
B 0006 ASDV      00026*00052 00092
B 0007 ASDVFG    00027*00041 00059 00078
RP      BUMPN     00013*00065 00115
RB      CGW       00017*00064 00114
RB      CNVTAB    00015*00048 00054 00089 00091 00107

```

PAGE 004 DVSPU DIVES+SYM PULLUPS AH1S 11/4/78

RB CNZ 00015*00045 00081 00104
RB CQ 00015*00042 00098
RB CRQL 00015*00038 00120
RB CVL 00016*00067
B 0000 DVFG 00022*00034 00077 00088
B 0001 DVTH 00023*00036 00063
P 0000 F7 00034*
P 0008 F7A 00038*00093
P 0010 F7B 00039 00042*
P 0016 F7B1 00043 00045*
P 003A F7E 00060 00063*
P 0041 F7F 00067*
P 0051 F7G 00070 00076*
P 0059 F7H 00035 00081*
P 0067 F7J 00085 00088*
P 0073 F7K 00082 00095*
P 0075 F7K0 00087 00096*
P 007F F7K1 00099 00101*
P 0085 F7L 00102 00104*
P 008B F7M 00107*00122
P 0091 F7N 00110*
P 00A5 F7T 00106 00120*
P 0057 F81X 00047 00079*
R FCASDV 00014*00061
R FCSMDV 00014*00058
R FCSMPU 00014*00112
P 00A9 G0 00079 00097 00109 00118 00122*
B 0008 LDTQFG 00028*00044 00056 00100 00110 00116
RB MODE 00016*00069
0086 NZ1.1 00019*00108
P 0053 RSTDV 00037 00051 00055 00057 00074 00077*
P 009F RSTPU 00111 00116*00121
B 0009 SPUGF 00029*00076 00096
B 000A SPUTM 00030*00101 00103 00113 00117
RB SVL 00016*00068
B 0004 T2 00024*00083 00086 00095
RB T23 00017*00071
RB T23A 00017*00072
RB TNDVFG 00017*00073

PAGE 001 TURNS TURNS + ASSYM FULLUPS AHIS 11/4/78

```

00001          NAM      TURNS
00002          TIT      TURNS + ASSYM FULLUPS AHIS 11/4/78
00003          OF1      REL,CREF,NOG

00005          *****
00006          *   NORMAL (HIGH SPEED) TURNS (3GW),(4VH)   *
00007          *   ASYMMETRICAL FULLUPS (3GW)               *
00008          *   GUNNERY TURNS (3GW),(4VH)                 *
00009          *   GUNNERY S-TURNS (3GW),(4VH)               *
00010          *   HIGH SPEED AUTOROTATION TURNS (3GW),(2NZ) *
00011          *****

00013          *AUTO TURN - ANY TURN DURING WHICH TO 10PSI
00014          *ASYM FULLUP - ANY TURN DURING WHICH DIVE SECTION
*****ERROR 207
00015F 0000 00 0000 A          SETS TURN DIVE FLAG.
00016          *NORMAL TURN - 1.3 < NZ < 1.5
00017          *GUN S TURN - NZ > 1.5 + SECONDARY TURN WHERE
*****ERROR 207
00018F 0003 00 0000 A          ROLL > 25 DEG.
00019          *GUN TURN - NZ > 1.5

00021          XREF      BSCT:BUMPT,BUMPT2,BUMFN
00022          XREF      ANY:FCASPU
00023          XREF      ANY:FCGNTN,FCGSTN,FCNRTN,FCAUTN
00024          XREF      BSCT:CKOL,CNZ,CBW,SGW,CQ,TB6,CT
00025          XREF      BSCT:T23,MODE,CVL,SVL,CVH,SVH,CRPM
00026          XREF      BSCT:TQH1,TQLO,M,NZLO,NZHI,GTS
00027          XREF      BSCT:QMOD,T23A,ZERO,NZE,TNDVFG
00028          XREF      BSCT:CNT,BAA

00030B 0000          BSCT
00031B 0000          0001 A NMHYTE RMB 1

```

PAGE 002 TURN5 TURN6 + ASSYM FULLUPS AHIS 11/4/78

00033F	0006			FSET		
00034F	0006	86 09	A F19	LDAA	#9	
00035F	0008	97 00	B	STAA	NMBYTE	FOR 3 BYTE TURN FCC'S
00036F	000A	C6 01	A	LDAA	#1	
00037F	000C	6D 00	A	TST	CROL,X	ROLL=10?
00038F	000E	2B 6D 007D		RMI	F13N	NO, BR
00039F	0010	86 00	A	LDAA	#T23	
00040F	0012	BD 0000	A	JSR	RUMPT	
00041F	0015	6D 00	A	TST	MODE,X	MODE=X? (0)
00042F	0017	26 16 002F		BNE	F13D	NO, BR
00043F	0019	96 00	A	LDAA	CNZ	
00044F	001B	81 03	A	CMFA	#3	NZ = 1.3 ?
00045F	001D	2A 0E 007D		RFL	F13C	YES, BR
00046F	001F	96 00	A	LDAA	CVL	SAVE CVH, CVL, CGW
00047F	0021	97 00	A	STAA	SVL	
00048F	0023	96 00	A	LDAA	CVH	
00049F	0025	97 00	A	STAA	SVH	
00050F	0027	96 00	A	LDAA	CGW	
00051F	0029	97 00	A	STAA	SGW	
00052F	002B	20 02 002F		BRA	F13D	
00053F	002D	D7 00	A F13C	STAR	NZE	SET NZE FLAG
00054F	002F	6F 00	A F13D	CLR	MODE,X	SET MODE=Y (-1)
00055F	0031	6A 00	A	DEC	MODE,X	
00056F	0033	6D 00	A F13E	TST	CQ,X	TQ=10?
00057F	0035	2B 0F 0046		BMI	F13F	YES, BR
00058F	0037	86 00	A	LDAA	#T86	INC T86
00059F	0039	BD 0000	A	JSR	RUMPT	
00060F	003C	96 00	A	LDAA	T86	
00061F	003E	81 14	A	CMFA	#20	2 SECS?
00062F	0040	26 08 004A		BNE	F13G	NO, BR
00063F	0042	D7 00	A	STAR	TQHI	SET HITQ FLAG
00064F	0044	20 04 004A		BRA	F13G	
00065F	0046	D7 00	A F13F	STAR	TQLO	SET LOTQ FLAG
00066F	0048	DF 00	A	STX	T86	CLEAR T86
00067F	004A	6D 00	A F13G	TST	M,X	M SET?
00068F	004C	26 0E 005C		BNE	F13J	YES, BR
00069F	004E	96 00	A F13H	LDAA	CNZ	
00070F	0050	81 03	A	CMFA	#3	
00071F	0052	27 04 005B		REQ	F13I2	1.3=NZ<1.5
00072F	0054	2B 0C 0062		BMI	F13J1	NZ<1.3, BR
00073F	0056	D7 00	A	STAR	NZHI	SET HI NZ FLAG
00074F	0058	D7 00	A F13I2	STAR	NZLO	SET LO NZ FLAG
00075F	005A	20 06 0062		BRA	F13J1	
00076F	005C	6D 00	A F13J	TST	CROL,X	ROLL 25?
00077F	005E	2F 02 0062		RFL	F13J1	NO, BR
00078F	0060	D7 00	A	STAR	GTS	SET GTS
00079F	0062	6D 00	A F13J1	TST	CT,X	GND COND?
00080F	0064	26 06 006C		BNE	F13K	YES, BR
00081F	0066	96 00	A	LDAA	CRPM	RPM 250?
00082F	0068	81 FC	A	CMFA	#-4	
00083F	006A	26 0E 007A		BNE	F13L	NO, EXIT
00084F	006C	86 00	A F13K	LDAA	#(MOD-123A)	CLR FLAGS
00085F	006E	6F 00	A F13K1	CLR	T23A,X	AND SET MODE=X
00086F	0070	08		INX		
00087F	0071	4A		DECA		
00088F	0072	26 FA 006E		BNE	F13K1	
00089F	0074	DE 00	A	LDX	ZERO	
00090F	0076	6F 00	A	CLR	GTS,X	

PAGE 003 TURNS TURNS 4 ASSYM PULLUPS AH1S 11/4/78

```

00091F 0078 DF 00 A STX T23 CLEAR T23
00092F 007A 7E 0111 F F13L JMP G0+3 EXIT

00094F 007D 6D 00 A F13N TST MODE,X MODE=X?
00095F 007F 27 F9 007A BEQ F13L YES,EXIT
00096F 0081 2B 0F 00F2 BMI F13R MODE=Y? YES,BR
00097F 0083 96 00 A LDAA T23
00098F 0085 81 64 A CMFA #100 10 SECS UP?
00099F 0087 27 30 00B9 BEQ F13RZ YES,BR
00100F 0089 86 00 A F13F LDAA #T23 INC T23
00101F 008B BD 0000 A JSR BUMPT
00102F 008E 97 00 A STAA MODE SET MODE=Z (1)
00103F 0090 20 A1 0033 BRA F13E

00105F 0092 6D 00 A F13R TST NZLO,X NZLO SET?
00106F 0094 27 D6 006C BEQ F13K NO,BR
00107F 0096 D7 00 A STAB M SET M
00108F 0098 6D 00 A TST NZE,X NZE SET?
00109F 009A 27 04 00A0 BEQ F13R1 NO,BR
00110F 009C 6D 00 A TST TNDVFG,X TURN DIVE FLAG SET ?
00111F 009E 27 15 00B5 BEQ F13RC NO,BR
00112F 00A0 6D 00 A F13R1 TST TQLO,X TQLO SET?
00113F 00A2 27 04 00A8 BEQ F13RA NO,BR
00114F 00A4 6D 00 A TST TQHI,X TQHI SET?
00115F 00A6 26 D0 00B5 BNE F13RC YES,BR
00116F 00A8 96 00 A F13RA LDAA T23
00117F 00AA 97 00 A STAA BAA
00118F 00AC 96 01 A LDAA T23+1
00119F 00AE 97 01 A STAA BAA+1
00120F 00B0 86 00 A LDAA #T23A
00121F 00B2 BD 0000 A JSR BUMPT2 ADD T23 TO T23A
00122F 00B5 DF 00 A F13RC STX T23 CLEAR T23
00123F 00B7 20 D0 00B9 BRA F13F
00124 *****
00125 * AUTOROTATIVE TURNS *
00126 *****

00128F 00B9 6D 00 A F13RZ TST TQLO,X TQ LO SET?
00129F 00BB 27 0E 00CB BEQ F13T NO,BR
00130F 00BD 6D 00 A TST NZHI,X NZHI SET?
00131F 00BF 27 05 00C6 BEQ F13S NO,BR
00132F 00C1 CE 0009 A LDX #FCAUTN+9 NZ > 1.5
00133F 00C4 20 41 0107 BRA F13ZA
00134F 00C6 CE 0000 A F13S LDX #FCAUTN NZ < 1.5
00135F 00C9 20 3C 0107 BRA F13ZA

00137 *****
00138 * NORMAL TURNS *
00139 *****

00141F 00CB 7D 0000 A F13T TST TNDVFG TURN DIVE FLAG SET ?
00142F 00CE 26 1E 00EE BNE F13V YES,BR TO ASSYM PULLUP
00143F 00D0 6D 00 A TST NZHI,X NZHI SET?
00144F 00D2 26 21 00F5 BNE F13Y YES,BR TO GUN TURNS
00145F 00D4 CE 0000 A LDX #FCNRTN POINT TO NORMAL TURNS

```

PAGE 004 TURNS TURNS + ASSYM PULLUPS AH15 11/4/78

```
00147 *****
00148 *      BUMP X POINTER      *
00149 *      FER SVH            *
00150 *****
```

```
00152F 00D7 C6 03      A F13T1 LDAB  #3
00153F 00D9 D7 00      A      STAB  CNT
00154F 00DB 96 00      A      LDAA  SVH
00155F 00DD 2B 28 0107 F13U  BMI   F13ZA
00156F 00DF D6 00      B      LDAB  NMBYTE
00157F 00E1 0B          F13U1  INX
00158F 00E2 5A          DECIB
00159F 00E3 26 FC 00E1  BNE   F13U1
00160F 00E5 7A 0000  A      DEC   CNT
00161F 00E8 27 1D 0107  BEQ   F13ZA
00162F 00EA 80 02      A      SUBA  #2
00163F 00EC 20 EF 00DD  BRA   F13U
```

```
00165 *****
00166 *      ASYMMETRICAL PULLUPS  *
00167 *****
```

```
00169F 00EE 6F 00      A F13V  CLR   TNDVFG,X CLEAR TURN DIVE FLAG
00170F 00F0 CE 0000  A      LDX   #FCASPU POINT TO ASSYM PULLUP
00171F 00F3 20 12 0107  BRA   F13ZA
```

```
00173 *****
00174 *      GUNNERY TURNS        *
00175 *      GUNNERY S TURNS     *
00176 *****
```

```
00178F 00F5 86 06      A F13Y  LDAA  #6
00179F 00F7 97 00      B      STAA  NMBYTE  FOR 2 BYTE TURN FCC'S
00180F 00F9 6D 00      A      TST   GTS,X   GUN S-TURN?
00181F 00FB 26 05 0102  BNE   F13YA  YES,BR
00182F 00FD CE 0000  A      LDX   #FCGNTN POINT TO GUN TURNS
00183F 0100 20 D5 00D7  BRA   F13T1
```

```
00185F 0102 CE 0000  A F13YA  LDX   #FCGSTN POINT TO GUN S TURN
00186F 0105 20 D0 00E7  BRA   F13T1
```

```
00188F 0107 86 00      A F13ZA LDAA  #T23A
00189F 0109 D6 00      A      LDAB  SGW    GET GROSS WT
00190F 010B BD 0000  A      JSR   BUMPN
00191F 010E 7E 006C  P GO    JMP   F13K
00192      END
```

TOTAL ERRORS 00002

```
RB      BAA      00028*00117 00119
RF      BUMPN     00021*00190
RF      BUMPT     00021*00040 00059 00101
RF      BUMPT2    00021*00121
RB      CGW       00024*00050
RB      CNT       00028*00153 00160
RB      CNZ       00024*00043 00069
RB      CQ        00024*00056
```

PAGE 005 TURNS TURNS + ASSYM PULLUPS AHIS 11/4/78

```

RB      CRDL  00024*00037 00076
RB      CRFM  00025*00081
RB      CT    00024*00079
RB      CVH   00025*00048
RB      CVL   00025*00046
F 002D F13C  00045 00053*
F 002F F13D  00042 00052 00054*
F 0033 F13E  00056*00103
F 0046 F13F  00057 00065*
F 004A F13G  00062 00064 00067*
F 004E F13H  00069*
F 0058 F13I2 00071 00074*
F 005C F13J  00068 00076*
F 0062 F13J1 00072 00075 00077 00079*
F 006C F13K  00080 00084*00106 00191
F 006E F13K1 00085*00088
F 007A F13L  00083 00092*00095
F 007D F13N  00038 00094*
F 0089 F13P  00100*00123
F 0092 F13R  00096 00105*
F 00A0 F13R1 00109 00112*
F 00A8 F13RA 00113 00116*
F 00B5 F13RC 00111 00115 00122*
F 00B9 F13RZ 00099 00128*
F 00C6 F13S  00131 00134*
F 00CB F13T  00129 00141*
F 00D7 F13T1 00152*00183 00186
F 00DD F13U  00155*00163
F 00E1 F13U1 00157*00159
F 00EE F13V  00142 00169*
F 00FS F13Y  00144 00178*
F 0102 F13YA 00181 00185*
F 0107 F13ZA 00133 00135 00155 00161 00171 00188*
F 0003 F19   00034*
R      FCASPU 00022*00170
R      FCAUTN 00023*00132 00134
R      FCGNTN 00023*00182
R      FCGSTN 00023*00185
R      FCNRTN 00023*00145
F 010E GO    00092 00191*
RB      GTS   00026*00078 00090 00180
RB      M     00026*00067 00107
RB      MODE  00025*00041 00054 00055 00094 00102
B 0000 NMBYTE 00031*00035 00156 00179
RB      NZE   00027*00053 00108
RB      NZHI  00026*00073 00130 00143
RB      NZLO  00026*00074 00105
RB      QMOD  00027*00084
RB      SGW   00024*00051 00189
RB      SVH   00025*00049 00154
RB      SVL   00025*00047
RB      T23   00025*00039 00091 00097 00100 00116 00118 00122
RB      T23A  00027*00084 00085 00120 00188
RB      T86   00024*00058 00060 00066
RB      TNDVFB 00027*00110 00141 00169
RB      TQHI  00026*00063 00114
RB      TQLQ  00026*00065 00112 00128
RB      ZERO  00027*00089

```

PAGE 001 NZPKS NZ PEAKS FCNZPK AHIS 11/4/78

00001 NAM NZPKS
00002 OPT REL,CREF
00003 TTL NZ PEAKS FCNZPK AHIS 11/4/78

00005 *****
00006 * FCNZPK >1.1 BY 3 GW *
00007 * >1.3 " *
00008 * >1.5 " *
00009 * .1.7 " *
00010 *****

00012 XREF ANY:FCNZPK
00013 XREF PSCT:BUMP
00014 XREF BSCT:C1,CNZ
00015 XREF BSCT:CNVTAB

00017 0083 A NZ1.05 EQU 131 NZ = 1.05 G THRESHOLD

00019B 0000 BSCT
00020B 0000 0001 A NZFARM RMB 1
00021B 0001 0001 A PKCNZ RMB 1

PAGE 002 NZPKS NZ PEAKS FCNZPK AH1S 11/4/78

```

00023P 0000                                PSCT

00025P 0000 D6 00      A PEAKS  LDAB  CNZ
00026P 0002 6D 00      B        TST  NZPARM,X PEAK IN PROGRESS ?
00027P 0004 26 0A 0010      BNE  PK1      YES,BR
00028P 0006 C1 02      A        CMPB  #2      NZ > 1.1 ?
00029P 0008 25 2B 0035      BCS  GO+2     NO,BR
00030P 000A D7 00      B        STAB  NZPARM  SET ARM MODE
00031P 000C D7 01      B        STAB  PKCNZ
00032P 000E 20 25 0035      BRA   GO+2

00034P 0010 D1 01      B PK1  CMPB  PKCNZ  NZ > STORED VALUE ?
00035P 0012 25 02 0016      BCS  PK2      NO,BR
00036P 0014 D7 01      B        STAB  PKCNZ  UPDATE PKCNZ
00037P 0016 D6 06      A PK2  LDAB  CNVTAB+6 GET CORRECTED NZ
00038P 0018 C1 83      A        CMPB  #NZ1.05 NZ < 1.05 ?
00039P 001A 24 19 0035      BCC  GO+2     NO,BR
00040P 001C CE 0000  A        LDX   #FCNZPK
00041P 001F D6 01      B        LDAB  PKCNZ
00042P 0021 C0 02      A        SUBB  #2      (B = 0,1,2 OR 3)
00043P 0023 27 09 002E PK3  BEQ  PK4
00044P 0025 86 06      A        LDAA  #6
00045P 0027 08          LPA      INX
00046P 0028 4A          DECA
00047P 0029 26 FC 0027      BNE  LPA
00048P 002B 5A          DECB
00049P 002C 20 F5 0023      BRA   PK3

00051P 002E 86 00      A PK4  LDAA  #C1      CONSTANT 1
00052P 0030 BD 0000  A        JSR   BUMP
00053P 0033 DF 00      B GO    STX   NZPARM  CLEAR NZARM,PKCNZ
00054                                END

TOTAL ERRORS 00000

```

```

RP      BUMP      00013*00052
RB      C1        00014*00051
RB      CNVTAB    00015*00037
RB      CNZ       00014*00025
R       FCNZPK    00012*00040
P 0033 GO        00029 00032 00039 00053*
P 0027 LPA       00045*00047
      0083 NZ1.05 00017*00038
B 0000 NZPARM    00020*00026 00030 00053
P 0000 PEAKS    00025*
P 0010 PK1      00027 00034*
P 0016 PK2      00035 00037*
P 0023 PK3      00043*00049
P 002E PK4      00043 00051*
B 0001 PKCNZ    00021*00031 00034 00036 00041

```

PAGE 001 HIST2 HISTOGRAMS VERSION 2 AH1S 11/4/78

00001 NAM HIST2
00002 OPT REL,CREF
00003 TTL HISTOGRAMS VERSION 2 AH1S 11/4/78

00005 *****
00006 * HISTOGRAMS FOR *
00007 * GROSS WEIGHT (3) *
00008 * DENSITY ALT (11) *
00009 * RPM (7) *
00010 * TORQUE (6) *
00011 * (-2)BUMP FLT TIME 1/SEC *
00012 *****

00014 XDEF HISTOG
00015 XREF ANY:FCGWHS,FCDHHS,FCRPMH,FCTQHS
00016 XREF PSCT:BUMPN
00017 XREF BSCT:CGW,CQ,C1,DALT,CNVTAB
00018 XREF BSCT:FTIME2,EXPTR,FTIME,ZERO

00020 000B A RPM5 EQU 11 RPM = 5 VALUE
00021 0066 A RPM314 EQU 102 RPM = 314 THRESHOLD

```

00023P 0000                                PSCT

00025P 0000 DE 00      A      LDX      FTIME2
00026P 0002 08                                INX
00027P 0003 8C 0258    A      CPX      #600      1 MINUTE UP ?
00028P 0004 24 05 000D    BNE      NOT1      NO,BR
00029P 0008 7C 0000    A      INC      FTIME
00030P 000B DE 00      A      LDX      ZERO
00031P 000D DF 00      A NOT1    STX      FTIME2

00033P 000F CE 0000    A HISTOG LDX      #FCGWSH  GROSS WEIGHT POINTER
00034P 0012 D6 00      A      LDAB     CGW
00035P 0014 8D 3A 0050    BSR      LAB9B

00037P 0016 CE 0000    A      LDX      #FCDAHS  DENSITY ALT POINTER
00038P 0019 96 00      A      LDAA     DALT      GET DENSITY ALT
00039P 001B 80 0C      A LP1     SUBA     #12      < THRESHOLD ?
00040P 001D 25 08 0027    BCS      LAB14     YES,BR
00041P 001F 08                                INX
00042P 0020 08                                INX
00043P 0021 08                                INX
00044P 0022 8C 001E    A      CPX      #FCDAHS+30
00045P 0025 26 F4 001B    BNE      LP1
00046P 0027 8D 26 004F LAB14 BSR      LAB9

00048P 0029 CE 0000    A RPMHIS LDX      #FCRPMH
00049P 002C 96 00      A      LDAA     CNVTAB+0 GET RPM CONVERSION
00050P 002E 81 66      A LP3     CMFA     #RPM314  RPM < THRESHOLD ?
00051P 0030 24 0A 003C    BCC      LAB24     YES,BR
00052P 0032 8B 0B      A      ADDA     #RPM5
00053P 0034 08                                INX
00054P 0035 08                                INX
00055P 0036 08                                INX
00056P 0037 8C 0012    A      CPX      #FCRPMH+18 DONE ?
00057P 003A 26 F2 002E    BNE      LP3      NO,BR
00058P 003C 8D 11 004F LAB24 BSR      LAB9

00060P 003E CE 0000    A      LDX      #FCTQHS  TORQUE POINTER
00061P 0041 96 00      A      LDAA     CQ
00062P 0043 2B 06 004B LP4    BMI      LAB27
00063P 0045 08                                INX
00064P 0046 08                                INX
00065P 0047 08                                INX
00066P 0048 4A                                DECA
00067P 0049 20 F8 0043    BRA      LP4
00068P 004B 8D 02 004F LAB27 BSR      LAB9
00069P 004D 20 07 0056    BRA      GO+1

00071P 004F 5F                                LAB9 CLR
00072P 0050 86 00      A LAB9B LDAA     #C1
00073P 0052 BD 0000    A      JSR      BUMPN
00074P 0055 39                                GO
00075                                RTS
                                END

TOTAL ERRORS 00000

```

RF BUMPN 00016*00073

PAGE 003 HIST2 HISTOGRAMS VERSION 2 AHIS 11/4/78

RB	C1	00017*00072	
RB	CGW	00017*00034	
RB	CNVTAB	00017*00049	
RB	CQ	00017*00061	
RB	DALT	00017*00038	
RB	EXPTR	00018*	
R	FCDHS	00015*00037	00044
R	FCGWHS	00015*00033	
R	FCRPMH	00015*00048	00056
R	FCTQHS	00015*00060	
RB	FTIME	00018*00029	
RB	FTIME2	00018*00025	00031
F 0055	GO	00069	00074*
DP 000F	HISTOG	00014	00033*
F 0027	LAB14	00040	00046*
F 003C	LAB24	00051	00058*
F 004B	LAB27	00062	00068*
F 004F	LAB9	00046	00058 00068 00071*
F 0050	LAB9B	00035	00072*
F 001B	LP1	00039*00045	
F 002E	LP3	00050*00057	
F 0043	LP4	00062*00067	
F 000D	NOT1	00028	00031*
	0066	RPM314	00021*00050
	000B	RPM5	00020*00052
F 0029	RPMHIS	00048*	
RB	ZERO	00018*00030	

PAGE 001 RCRD1 ACCEL-CLM,CLIMB,CRUISE & DESCENT AH15 11/4/78

00001 NAM RCRD1
00002 OPT REL,CREF
00003 TTL ACCEL-CLM,CLIMB,CRUISE & DESCENT AH

00005 *****
00006 * FCACCM ACCEL-CLIMB (3GW) *
00007 * FCCLMB CLIMB (3GW) *
00008 * FCHVR HOVER (3GW) *
00009 * FCCRUZ CRUISE (BVH)(3GW) *
00010 * FCDSNT DESCENT (3GW) *
00011 * BUMP DIVE TABLE *
00012 * WAIT FOR 10 HZ *
00013 *****

00015 XDEF WAIT,BENTER
00016 XREF ANY:MUXCR,MUX,FCCLMB,FCACCM
00017 XREF ANY:FCHVR,FCCRUZ,FCDSNT
00018 XREF PSCT:BUMP,TENHZ
00019 XREF BSCT:CRD,DVTABL,C1

00021B 0000 RSCT
00022B 0000 0001 A HURF RMB 1
00023B 0001 0001 A MAYBE RMB 1
00024B 0002 0001 A MAYBE1 RMB 1
00025B 0003 0003 A T12 RMB 3
00026B 0006 0001 A TCRD RMB 1

00029F 0000 PSCT
00031F 0000 E6 00 A RCRD LDAB CRD,X IS RC VALID ? (NOT -)
00032F 0002 2A 03 0007 BFL RCR1 YES, BRANCH
00033F 0004 7E 00AC F JMP WAIT ELSE GO TO WAIT
00034F 0007 6D 00 B RCR1 TST HURF,X IS HOVER FLAG SET ? (0)
00035F 0009 26 0F 001A BNE AB49 NO, BRANCH
00036F 000B 96 03 B LDAA T12 GET T12
00037F 000D 81 06 A CMFA #6 T12 = 6 ?
00038F 000F 27 05 0016 BEQ LAB48 YES, BRANCH
00039F 0011 4C INCA BUMP T12
00040F 0012 97 03 B STAA T12
00041F 0014 20 04 001A BRA LAB49 BRANCH
00042F 0016 97 00 B LAB48 STAA HURF RESET HOVER FLAG
00043F 0018 6F 03 B CLR T12,X CLEAR T12
00044F 001A 5D LAB49 TSTB TEST FOR RC OR RD
00045F 001B 27 21 003E BEQ CRUISE BRANCH IF CRUISE (0)
00046F 001D 5A DECB CLIMB OR DESCENT ?
00047F 001E 27 5A 007A BEQ DESCNT BR IF DESCENT
00048F 0020 D7 06 B STAB TCRD

PAGE 002 RCRD1 ACCEL-CLM,CLIMB,CRUISE & DESCENT AH1S 11/4/78

```

00050P 0022 6D 3C A CLIMB TST DVATABL+60,X IS A/S > 0.5 ? (NOT -)
00051P 0024 2B 2E 0054 BMI BR9 NO, BRANCH
00052P 0026 CE 0000 A LDX #FCCLMB POINT TO CLIMB
00053P 0029 86 00 A LDAA #C1 ADD 1
00054P 002B BD 0000 A JSR BUMP BUMP FCC BY GW
00055P 002E 6D 00 B TST HVRF,X IS HOVER FLAG SET ? (0)
00056P 0030 26 22 0054 BNE BR9 NO, BRANCH
00057P 0032 CE 0000 A LDX #FCACCM POINT TO ACCEL TO CLIMB
00058P 0035 86 03 B LDAA #T12 ADD T12
00059P 0037 BD 0000 A JSR BUMP BUMP FCC BY GW
00060P 003A D7 00 B STAB HVRF RESET HOVER FLAG
00061P 003C 20 16 0054 BRA BR9 BRANCH

```

```

00063P 003E 96 3C A CRUISE LDAA DVATABL+60 GET A/S AT T(-30)
00064P 0040 81 FE A CMPA #-2 A/S>0.3 ?
00065P 0042 26 13 0057 BNE LAB50 YES, BRANCH
00066P 0044 6D 3B A TST DVATABL+59,X TORQ>20 ?
00067P 0046 26 0C 0054 BNE BR9 NO, BRANCH
00068P 0048 CE 0000 A LDX #FCHVR POINT TO HOVER
00069P 004B 86 00 A LDAA #C1 ADD 1
00070P 004D BD 0000 A JSR BUMP BUMP FCC BY GW
00071P 0050 6F 00 B CLR HVRF,X SET HOVER FLAG (0)
00072P 0052 6F 03 B CLR T12,X CLEAR T12
00073P 0054 7E 008A P BR9 JMP BENTER JUMP TO BUMP ENTRY
00074P 0057 6D 3A A LAB50 TST DVATABL+58,X ROLL<10 ? (0)
00075P 0059 26 F9 0054 BNE BR9 NO, BRANCH
00076P 005B 96 3B A LDAA DVATABL+56 NZ<1.3 ? (<3)
00077P 005D 26 F5 0054 BNE BR9 NO, BRANCH
00078P 005F 6D 3B A TST DVATABL+59,X TORQ>20 ? (NOT -)
00079P 0061 26 F1 0054 BNE BR9 NO, BRANCH
00080P 0063 CE 0000 A LDX #FCCRUIZ POINT TO CRUISE
00081P 0066 96 3C A LDAA DVATABL+60 GET A/S AT T(-30)
00082P 0068 2B 09 0073 LPCR BMI LAB57
00083P 006A C6 06 A LDAB #6
00084P 006C 0B LPCR1 INX
00085P 006D 5A DECB
00086P 006E 26 FC 006C BNE LPCR1
00087P 0070 4A DECA
00088P 0071 20 F5 006B BRA LPCR
00089P 0073 86 00 A LAB57 LDAA #C1 ADD 1
00090P 0075 BD 0000 A JSR BUMP BUMP FCC BY GW
00091P 0078 20 10 008A BRA BENTER BRANCH

```

12
F

PAGE 003 RCRD1 ACCEL CLM,CLIMB,CRUISE & DESCENT AH15 11/4/78

```

00093F 007A 5A          DESCNT DECB
00094F 007B D7 06      B      STAB   TCRD
00095F 007D 7D 003C    A      TST    DVATABL+60 A/S>0.5 ?
00096F 0080 2B 08 008A  BMI      BENTER  NO, BRANCH
00097F 0082 CE 0000    A      LDX     #FCDSNT DESCENT POINTER
00098F 0085 86 00      A      LDAA    #C1      ADD 1
00099F 0087 BD 0000    A      JSR     BUMP     BUMP FCC BY GW

00101F 008A CE 0048    A BENTER LDX     #DVATABL+72
00102F 008D A6 00      A BFLP1  LDAA    0,X
00103F 008F A7 02      A      STAA    2,X
00104F 0091 09          DEX
00105F 0092 8C 003C    A      CPX     #DVATABL+60
00106F 0095 26 F6 008D  BNE     BFLP1
00107F 0097 CE 0036    A      LDX     #DVATABL+54
00108F 009A 09          BFLP2  DEX
00109F 009B A6 00      A      LDAA    0,X
00110F 009D A7 09      A      STAA    9,X
00111F 009F 8C 0000    A      CPX     #DVATABL
00112F 00A2 26 F6 009A  BNE     BFLP2
00113F 00A4 6F 02      A      CLR     2,X
00114F 00A6 6F 03      A      CLR     3,X
00115F 00A8 6F 04      A      CLR     4,X
00116F 00AA 6F 05      A      CLR     5,X
00117F 00AC B6 0000    A WAIT    LDAA    MUXCR    WAIT FOR 10 HZ
00118F 00AF 2A FB 00AC  BFL     WAIT
00119F 00B1 B6 0000    A      LDAA    MUX     CLR 10 HZ FLAG
00120F 00B4 7E 0000    A      JMP     TENHZ
00121          END
TOTAL ERRORS 00000

```

12
B

```

DF 008A BENTER 00015 00073 00091 00096 00101*
F 008D BFLP1 00102*00106
F 009A BFLP2 00108*00112
F 0054 BR9 00051 00056 00061 00067 00073*00075 00077 00079
RF BUMP 00018*00054 00059 00070 00090 00099
RB C1 00019*00053 00069 00089 00098
F 0022 CLIMB 00050*
RB CRD 00019*00031
F 003E CRUISE 00045 00063*
F 007A DESCNT 00047 00093*
RB DVATABL 00019*00050 00063 00066 00074 00076 00078 00081 00095
00101 00105 00107 00111
R FCACCH 00016*00057
R FCCLMB 00016*00052
R FCCRUZ 00017*00080
R FCDSNT 00017*00097
R FCHVR 00017*00068
B 0000 HURF 00022*00034 00042 00055 00060 00071
F 0016 LAB48 00038 00042*
F 001A LAB49 00035 00041 00044*
F 0057 LAB50 00045 00074*
F 0073 LAB57 00082 00089*
F 0068 LPCR 00082*00088
F 006C LPCR1 00084*00086
B 0001 MAYBE 00023*

```

PAGE 004 RCRD1 ACCEL-CLM,CLIMB,CRUISE & DESCENT AHIS 11/4/78

B 0002 MAYBE1 00024*
R MUX 00016*00119
R MUXCR 00016*00117
P 0007 RCR1 00032 00034*
P 0000 RCRD 00031*
B 0003 T12 00025*00036 00040 00043 00058 00072
B 0006 TCRD 00026*00048 00094
RP TENHZ 00018*00120
DP 00AC WAIT 00015 00033 00117*00118

PAGE 001 BBUMP **BELL BUMP SUBROUTINES 6 DEC 77**

00001 NAM BBUMP
00002 OPT REL,CREF
00003 TTL **BELL BUMP SUBROUTINES 6 DEC 77**

00005 *****
00006 * BUMP *
00007 * SUBROUTINES *
00008 *****

00010 XDEF BUMP,BUMPN,BUMFT,BUMPT2,BAA
00011 XREF BSCT:ZERO,CGW

00013B 0000			BSCT	
00014B 0000	0002	A ASV	RMB	2
00015B 0002	0003	A BAA	RMB	3
00016B 0005	0002	A NDX1	RMB	2
00017B 0007	0002	A NDX2	RMB	2

PAGE 001 BUMP **BELL BUMP SUBROUTINES 6 DEC 77**

```

00019F 0000                                FSC1

00021F 0000 36                BUMFT  FSHA
00022F 0001 86 01            A        LDAA    #1
00023F 0003 97 02            B        STAA    BAA      * SET UP NUMBER
00024F 0005 6F 03            B        CLR     BAA+1,X  * TO BE ADDED
00025F 0007 6F 04            B        CLR     BAA+2,X  * TO COUNTER
00026F 0009 32                PULA
00027F 000A 6F 05            B BUMFT2 CLR     NDX1,X
00028F 000C 97 06            B        STAA    NDX1+1
00029F 000E DE 05            B        LDX     NDX1      ADDRESS OF COUNTER
00030F 0010 8D 43 0055      BSR     MFBA2
00031F 0012 DE 00            A        LDX     ZERO
00032F 0014 39                RTS

00034F 0015 37                BUMP    FSHB
00035F 0016 D6 00            A        LDAB    CGW
00036F 0018 20 01 001B      B        BRA     BUMP1
00037F 001A 37                BUMPN   FSHB
00038F 001B DF 05            B BUMP1   STX     NDX1      SAVE ADDRESS 1ST VAL
00039F 001D 7F 0000        B        CLR     ASV      GET ADDR 2ND VAL
00040F 0020 97 01            B        STAA    ASV+1
00041F 0022 DE 00            B        LDX     ASV      POINT TO # TO BE ADDED TO
00042F 0024 A6 00            A        LDAA    0,X      MOVE 2ND VAL TO BAA
00043F 0026 97 02            B        STAA    BAA
00044F 0028 A6 01            A        LDAA    1,X
00045F 002A 97 03            B        STAA    BAA+1
00046F 002C A6 02            A        LDAA    2,X
00047F 002E 97 04            B        STAA    BAA+2
00048F 0030 17                TBA
00049F 0031 97 07            B        STAA    NDX2      PUT GW RANGE IN REG A
00050F 0033 48                ASLA      SAVE GW (0,1,2)
00051F 0034 D6 05            B        LDAB    NDX1      CONVERT (0,2,4)
00052F 0036 C1 06            A        CMFB    #6
00053F 0038 26 02 003C      BNE      BUMP2      2 BYTE FCC ? (0 OR 1)
00054F 003A 9B 07            B        ADDA    NDX2      YES,BR
00055F 003C 9B 06            B BUMP2   ADDA    NDX1+1    ELSE CONVERT (0,3,6)
00056F 003E 97 06            B        STAA    NDX1+1    ADJUST ADDR 1ST VAL
00057F 0040 24 03 0045      BCC      NOCRY
00058F 0042 7C 0005        B        INC     NDX1
00059F 0045 DE 05            B NOCRY   LDX     NDX1
00060F 0047 C1 06            A        CMFB    #6
00061F 0049 27 04 004F      BEQ      BUMP3      2 BYTE FCC ?
00062F 004B 8D 08 0055      BSR     MFBA2      NO, 3-BYTE PRECISION
00063F 004D 20 02 0051      BRA     BUMPX      ELSE ADD 2-BYTE
00064F 004F 8D 08 0059      BUMP3   BSR     MFBA3      GO EXIT
00065F 0051 33                BUMPX   PULB      ADD 3-BYTE
00066F 0052 DE 00            A        LDX     ZERO
00067F 0054 39                RTS      RESET IX
                                      EXIT

```

PAGE 003 BRUMF **BELL RUMF SUBROUTINES 6 DEC 77**

```

00069F 0055 37      MFBA2  FSHR      2-BYTE ADD
00070F 0056 5F      CLRK
00071F 0057 20 03 005C      BRA      MPBAA
00072F 0059 37      MFBA3  FSHR      3-BYTE ADD
00073F 005A C6 01      A      LDAB      #1
00074F 005C 0F      MPBAA  SEI      DISABLE INTERRUPT
00075F 005D 36      FSHA
00076F 005E 96 02      B      LDAA      BAA
00077F 0060 A8 00      A      ADDA      0,X      ADD BYTE 1
00078F 0062 A7 00      A      STAA      0,X
00079F 0064 96 03      B      LDAA      BAA+1
00080F 0066 A9 01      A      ADCA      1,X      ADD BYTE 2
00081F 0068 A7 01      A      STAA      1,X
00082F 006A 07      TPA      SAVE CARRY STATUS
00083F 006B 5D      TSTR      IS THIS 3-BYTE ADD ?
00084F 006C 27 07 0075      BEQ      MPBAX      NO, GO EXIT
00085F 006E 06      TAP      RESTORE CARRY STATUS
00086F 006F 96 04      B      LDAA      BAA+2
00087F 0071 A9 02      A      ADCA      2,X      ADD BYTE 3
00088F 0073 A7 02      A      STAA      2,X
00089F 0075 0E      MFBA3  CLI      RE-ENABLE INTERRUPT
00090F 0076 32      FULA
00091F 0077 33      FULB
00092F 0078 39      RTS      EXIT
00093      END
TOTAL ERRORS 00000

```

```

B 0000 ASV      00014*00039 00040 00041
DB 0002 BAA      00010 00015*00023 00024 00025 00043 00045 00047 00076
      00079 00086
DB 0015 RUMF      00010 00034*
F 001B RUMF1      00036 00038*
F 003C RUMF2      00053 00055*
F 004F RUMF3      00061 00064*
DB 001A RUMFN      00010 00037*
DB 0000 RUMFT      00010 00021*
DB 000A RUMFT2      00010 00027*
F 0051 RUMFX      00063 00065*
RB      CGW      00011*00035
F 0055 MFBA2      00030 00062 00069*
F 0059 MFBA3      00064 00072*
F 005C MPBAA      00071 00074*
F 0075 MPBAX      00084 00089*
B 0005 NDX1      00016*00027 00028 00029 00038 00051 00055 00056 00058
      00059
B 0007 NDX2      00017*00049 00054
F 0045 NOCRY      00057 00059*
RB      ZERO      00011*00031 00066

```

PAGE 001 RCOM ** RECORDER COMMUNICATIONS (AHIS SIRS) ** 6 MAR 78

```

00001      NAM      RCOM
00002      OPT      REL,CREF,UNA
00003      TTL      ** RECORDER COMMUNICATIONS (AHIS SI
00004      XREF      PSCT;RESTR
00005      XREF      BSCT;TB6,CNVTAB,ADCNVT
00006      XREF      ANY:ACIACS,ACIAXR

```

```

00008      0000  A  ASMFLG SET  0      SIRS,BELL VERSIONS

```

```

00010F 0000      PSCT
00011F 0000 86 81  A RCOM  LDAA  ##81
00012F 0002 8D 58 005C    BSR  OUT
00013F 0004 86 7D  A      LDAA  ##7D
00014F 0006 8D 54 005C    BSR  OUT      SEND ALT MODE
00015F 0008 9D 48 0052 COM1 BSR  INF      WAIT FOR INPUT
00016F 000A 8D 50 005C    BSR  OUT      ACKNOWLEDGE INPUT
00017F 000C 36      PSHA      SAVE COMMAND
00018F 000D 8D 43 0052    BSR  INF      WAIT FOR PROCEED
00019F 000F 81 77  A      CMFA  ##77      CANCEL?
00020F 0011 27 07 001A    BEQ  COM12     YES,BR
00021F 0013 81 88  A      CMFA  ##88      PROCEED?
00022F 0015 27 06 001D    BEQ  COM0      YES,BR
00023F 0017 32      PULA
00024F 0018 20 32 004C    BRA  COM2D
00025F 001A 32      COM12 PULA
00026F 001B 20 EB 000B    BRA  COM1
00027F 001D 32      COM0 PULA
00028F 001E 81 EE  A      CMFA  ##EE      STATUS CHECK?

```

```

00030      FFFE  A      JFEQ  ASMFLG-2 DEMO VERSION ONLY
00031      BNE COM3 NO,BR
00032      ENDC

```

```

00034      FFFE  A      JFNE  ASMFLG-2 SIRS,BELL VERSIONS
00035F 0020 26 0A 002C    RNE  COM2
00036      ENDC

```

```

00038F 0022 8D 38 005C    BSR  OUT      XMIT START BYTE (EE)
00039F 0024 4F      CLRA
00040F 0025 8D 35 005C COM1A BSR  OUT      XMIT 0-FF
00041F 0027 4C      INCA
00042F 0028 27 DE 000B    BEQ  COM1      DONE,BR
00043F 002A 20 F9 0025    BRA  COM1A

```

```

00045      FFFE  A      JFNE  ASMFLG-2 BELL,SIRS VERSIONS
00046F 002C 81 DD  A COM2  CMFA  ##DD      COUNTER MEMORY CHECK?
00047F 002E 26 56 00B6    RNE  COM3      NO,BR
00048F 0030 8D 2A 005C    BSR  OUT
00049F 0032 CE 0400  A      LDX  ##400      LD ADDR OF CNTRS
00050F 0035 E6 00  A COM2A LDAB  0,X      SAVE CONTENTS
00051F 0037 37      PSHB
00052F 0038 4F      CLRA
00053F 0039 A7 00  A COM2B STAA  X      WRITE MEMORY
00054F 003B E6 00  A      LDAB  X      READ MEMORY

```


PAGE 002 RCOM ** RECORDER COMMUNICATIONS (AHIS SIRS) ** 6 MAR 78

00055F	003D	11			CBA		READ=WRITE?
00056F	003E	26	3A	007A	BNE	COM2E	NO, BR
00057F	0040	4C			INCA		TRY NEXT COMBO
00058F	0041	26	F6	0039	BNE	COM2B	NOT DONE, BR
00059F	0043	32			COM2C		
00060F	0044	A7	00	A	STAA	X	RESTORE CONTENTS
00061F	0046	08			INX		
00062F	0047	8C	0800	A	CPX	##800	DONE?
00063F	004A	26	E9	0035	BNE	COM2A	NO, BR
00064					ENDC		
00066F	004C	86	FF	A	COM2D	LDAA	##FF
00067F	004E	8D	0C	005C	BSR	OUT	CHECK COMPLETE
00068F	0050	20	B6	0008	BRA	COM1	GO WAIT FOR NXT COMND
00069					*		
00070F	0052	B6	0000	A	INP	LDAA	ACIACS
00071F	0055	47				ASRA	CHK STATUS
00072F	0056	24	FA	0052		RCC	NO DATA, BR
00073F	0058	B6	0000	A		LDAA	ACIAXR
00074F	005B	39				RTS	LOAD DATA BYTE
00075F	005C	37			OUT	PSHB	RETURN
00076F	005D	36				PSHA	SAVE ACCS
00077F	005E	F6	0000	A	OUT2	LDAB	ACIACS
00078F	0061	57				ASRB	
00079F	0062	24	0D	0071		RCC	OUT5
00080F	0064	B6	0000	A		LDAA	ACIAXR
00081F	0067	B1	77	A		CHTA	##77
00082F	0069	26	06	0071		BNE	OUT5
00083F	006B	32				FULA	NO, THEN IGNORE IT
00084F	006C	32				FULA	CLEAN UP STACK
00085F	006D	32				FULA	
00086F	006E	33				FULB	
00087F	006F	20	97	0008	OUT4	BRA	COM1
00088F	0071	57			OUT5	ASRB	DISCONTINUE OPERATION
00089F	0072	24	EA	005E		BCC	TDR FULL?
00090F	0074	32				FULA	YES, BR
00091F	0075	B7	0000	A		STAA	ACIAXR
00092F	0078	33				FULB	SEND IT
00093F	0079	39				RTS	RETURN
00095			FFFE	A		IFNE	ASMFLG--2
00096F	007A	DF	00	A	COM2E	STX	BELL, SIRS VERSIONS
00097F	007C	96	00	A		LDAA	T86
00098F	007E	8D	DC	005C		BSR	REPORT ERROR
00099F	0080	96	01	A		OUT	XMIT HI BYTE
00100F	0082	8D	D8	005C		LDAA	T86+1
00101F	0084	20	BD	0043		BSR	XMIT LO BYTE
00102						BRA	COM2C
						ENDC	CONTINUE
00104F	0086	B1	CC	A	COM3	CMPA	##CC
00105F	0088	26	11	009B		BNE	COM4
00106F	008A	8D	D0	005C		BSR	OUT
00107F	008C	CE	0400	A		LDX	##400
00108F	008F	A6	00	A	COM3B	LDAA	X
00109F	0091	8D	C9	005C		BSR	OUT
							COUNTER DATA?
							NO, BR
							XMIT START BYTE(CC)
							GET ADDR OF CNTRS
							XMIT COUNTER

PAGE 003 RCOM ** RECORDER COMMUNICATIONS (AH1S SIRS) ** 6 MAR 78

```

00110F 0093 08                INX
00111F 0094 8C 0800 A        CFX    $$800    DONE?
00112F 0097 26 F6 00BF        BNE    COM3B    NO, BR
00113F 0099 20 B1 004C        BRA    COM2D    XMIT COMPLETE
00114F 009B 81 BB A COM4      CMFA    $$BB    STAT RDGS, R S/N?
00115F 009D 26 14 00B3        BNE    COM5    NO, BR
00116F 009F 8D BB 005C        BSR    OUT    XMIT START(BB)
00117F 00A1 BD 0000 A        JSR    ADCNVT
00118F 00A4 CE 0000 A        LDX    #CNVTAB
00119F 00A7 C6 12 A        LDAB    #18
00120F 00A9 A6 00 A COM4B     LDAA    X        GET DATA
00121F 00AB 8D AF 005C        BSR    OUT    SEND IT
00122F 00AD 08                INX
00123F 00AE 5A                DECB
00124F 00AF 26 F8 00A9        BNE    COM4B    DONE?
00125F 00B1 20 99 004C COM4C  BRA    COM2D    NO, BR
00126F 00B3 81 AA A COM5     CMFA    $$AA    XMIT COMPLETE
                                CLR PEAK VALUES

00128                FFFE A        IFNE    ASMFLG-2 BELL, SIRS VERSIONS
00129F 00B5 26 22 00D9        BNE    COM8    NO, BR
00130                ENDC

00132                FFFE A        IFEQ    ASMFLG-2 DEMO VERSION
00133                BNE COM6 NO, BR
00134                ENDC

00136F 00B7 CE 0000 A        LDX    #0
00137F 00BA FF 05EC A        STX    $5EC
00138F 00BD FF 05EE A        STX    $5EE
00139F 00C0 FF 05F0 A        STX    $5F0
00140F 00C3 FF 05F2 A        STX    $5F2
00141F 00C6 FF 05F4 A        STX    $5F4
00142F 00C9 CE 06C3 A        LDX    $$6C3
00143F 00CC 5F                CLR B
00144F 00CD E7 00 A COM5E     STAB    X
00145F 00CF 08                INX
00146F 00D0 8C 0800 A        CFX    $$800
00147F 00D3 26 F8 00CD        BNE    COM5E
00148F 00D5 8D B5 005C        BSR    OUT
00149F 00D7 20 DB 00B1        BRA    COM4C    XMIT COMPLETE

00151                FFFE A        IFEQ    ASMFLG-2 DEMO VERSION ONLY
00152                COM6 CMFA $$99 RESTART NORMAL PROC
00153                BNE COM7 NO, BR
00154                BSR OUT
00155                LDX #45535
00156                COM6A DEX
00157                BNE COM6A DELAY
00158                JMP RESTRT RESTART
00159                COM7 CMFA $$55 CLEAR CNTR MEMORY
00160                BNE COM4C NO, BR
00161                BSR OUT
00162                LDX $$100
00163                CLRA

```

PAGE 004 RCOM ** RECORDER COMMUNICATIONS (AH1S SIRS) ** 6 MAR 78

```
00164          COM7A STAA X
00165          INX
00166          CPX ##200
00167          BNE COM7A
00168          BRA OUT4
00169          ENDC
```

```
00171          FFFE A          IFNE  ASMFLG-2 BELL,SIRS VERSIONS
00172F 00D9 B1 55 A COMB      CMFA  ##55  RECEIVE CALS?
00173F 00DB 26 D4 00B1      BNE    COM4C  NO,BR
00174F 00DD BD 005C F        JSR    OUT    YES,XMIT START BYTE (55)
00175F 00E0 CE 06B7 A        LDX    ##6B7  INITIALIZE INDEX
00176F 00E3 BD 0052 F COM8A   JSR    INP    GET VALUE FROM RTU
00177F 00E6 A7 00 A          STAA   X      STORE IT
00178F 00E8 08              INX          BUMP INDEX
00179F 00E9 8C 06C3 A        CPX    ##6C3  DONE?
00180F 00EC 26 F5 00E3      BNE    COM8A  NO,BR
00181F 00EE 20 C1 00B1      BRA    COM4C  XMIT COMPLETE
00182          ENDC
```

```
00184          *****
00185          *      INTERRUPT ROUTINE      *
00186          *****
```

```
00188F 00F0 B6 0000 A IRQ     LDAA   ACIACS
00189F 00F3 2A FE 00F3 BR      BPL    BR      MUST BE POWER FAILURE
00190F 00F5 7E 0000 F        JMP    RCOM    MUST BE ACIA INTERRUPT
```

```
00192          *****
00193          *      VECTOR ADDRESSES      *
00194          *****
```

```
00196A C7F8          ORG      $C7F8
```

```
00198A C7F8          00F0 F      FDB    IRQ
00199A C7FA          00F0 F      FDB    IRQ      SWI NOT USED
00200A C7FC          00F0 F      FDB    IRQ      NMI NOT USED
00201A C7FE          0000 A      FDB    RESTRT  POWER UP RESTART
00202          END
TOTAL ERRORS 00000
```

```
R      ACIACS 00006*00070 00077 00188
R      ACIAXR 00006*00073 00080 00091
RB     ADCNVT 00005*00117
S 0000 ASMFLG 00008*00030 00034 00045 00095 00128 00132 00151 00171
F 00F3 BR      00189*00189
RB     CNUVTAB 00005*00118
F 001D COM0    00022 00027*
F 0008 COM1    00015*00026 00042 00068 00087
F 001A COM12   00020 00025*
F 0025 COM1A   00040*00043
F 002C COM2    00035 00046*
F 0035 COM2A   00050*00063
F 0039 COM2B   00053*00058
F 0043 COM2C   00059*00101
```

PAGE 005 RCOM ** RECORDER COMMUNICATIONS (AHIS SIRS) ** 6 MAR 78

F 004C COM2D 00024 00066*00113 00125
F 007A COM2E 00056 00096*
F 0086 COM3 00047 00101*
F 008F COM3B 00108*00112
F 009B COM4 00105 00114*
F 00A9 COM4B 00120*00124
F 00B1 COM4C 00125*00149 00173 00181
F 00B3 COM5 00115 00126*
F 00CD COM5E 00144*00147
F 00D9 COM8 00129 00172*
F 00E3 COM8A 00176*00180
F 0052 INF 00015 00018 00070*00072 00176
F 00F0 IRQ 00188*00198 00199 00200
F 005C OUT 00012 00014 00016 00038 00040 00048 00067 00075*00098
00100 00106 00109 00116 00121 00148 00174
F 005E OUT2 00077*00089
F 006F OUT4 00087*
F 0071 OUT5 00079 00082 00088*
F 0000 RCOM 00011*00190
RF RESTRT 00004*00201
RB T86 00005*00096 00097 00099

```

RLOAD
M6800 LINKING LOADER REV 1.1
COPYRIGHT BY MOTOROLA 1976
?IF=FILL:1
?STRB=0
?STRF=$3000
?LOAD=SGB20:1,SFC:1,SADO:1,SVV:1
?LOAD=SRT30:1,SET40:1,SCD:1,SLD0:1
?LOAD=SRC:1,SFL:1,STRO:1
?CURF=$9000
?LOAD=SDVO:1
?CURF=$0
?LOAD=STN:1,SNP:1,SHS20:1,SDC:1,SBP:1,SDLO:1
?BO=AHIS:1
?ABSP
?MAFF

```

```

NO UNDEFINED SYMBOLS
MAP

```

```

S SIZE STR END COMN
A 0008 C7F8 C7FF
B 00F6 0000 00F5 0000
C 0000 0000 FFFF 0000
D 0000 0000 FFFF 0000
P 9469 3000 C468 0000
MODULE NAME BSCT DSCT PSCT
GNDRS2 0000 0000 3000
FCCLST 008F 0000 3000
BADM P 008F 0000 3000
SVLVH 0094 0000 31DC
SRT3 0098 0000 32BC
STO1 009B 0000 3370
CDRTS 00B7 0000 34E4
LNDGS2 00BA 0000 35D2
BRPMC 00CE 0000 3694
BFLAR 00D1 0000 36C5
TRIVAR 00D3 0000 3712
DVSPU 00D6 0000 C000
TURNS 00E3 0000 C0AB
NZPKS 00E4 0000 C186
HIST 00E6 0000 C1EB
RCRD1 00E6 0000 C241
BBUMP 00ED 0000 C2F8
RCOM 00F6 0000 C371

```

DEFINED SYMBOLS

NAME	S	STR	NAME	S	STR	NAME	S	STR	NAME	S	STR
ACOFF	B	0039	ALTFT	B	0034	CGW	B	001E	CHD	B	0018
CNVTAB	B	0023	CNZ	B	0017	CQ	B	001B	CRD	B	0020
CRFM	B	001D	CRUD	B	0021	CT	B	001F	CVH	B	001A
DALT	B	0022	DVTABL	B	003D	EXFLG	B	008E	EXPTR	B	0089
FTIME2	B	008C	GTS	B	0006	KNOTS	B	0033	M	B	000A
MSNDX	B	0037	NUM	B	0036	NZE	B	000B	NZHI	B	000C
PWONTH	B	003A	QMOD	B	0013	SGW	B	0010	SHFTCT	B	0035
SVL	B	000F	T23	B	0014	T23A	B	0003	T86	P	0011
TQHI	B	0008	TQLO	B	0009	VL DLY	B	008B	ZERO	B	0001
ALTSLP	A	06BA	ARM	A	05F7	ASINT	A	06BB	ASSLP	A	06BC
FCASDV	A	0654	FCASPU	A	0666	FCAULD	A	05EA	FCAUTH	A	0642
FCCLMB	A	0466	FCCRZ	A	0436	FCDASH	A	066F	FCDAPK	A	05F0
FCFLAR	A	0478	FCGNTM	A	0609	FCGNTN	A	0400	FCGSTN	A	0418
FCGWPK	A	05F4	FCHVR	A	0430	FCNRTN	A	060C	FCNZPK	A	047E
FCOATL	A	05F3	FCPKNZ	A	05F1	FCRLPK	A	05F5	FCRPMC	A	05E6
FCRPMF	A	05EC	FCSMDV	A	064B	FCSMPU	A	065D	FCTOLD	A	05EB
FCTQPK	A	05ED	FCTRVR	A	0496	FCVHPK	A	05EF	FCVLPK	A	05EE
GWINT	A	06BD	GWSLP	A	06BE	NZINT	A	06B7	NZSLP	A	06B8
RUDSLP	A	06C2	TQINT	A	06BF	TQSLP	A	06C0	ACIACS	A	1000
ADCNVT	P	304F	ALTABL	P	3599	ASTABL	P	35B4	LINEAR	P	3139
MPY7	P	31A2	MPY8	P	319B	MUX	A	2002	MUXCR	A	2003
RESTRT	P	3010	SHIFT	P	31CA	STACK	A	00FF	TENNZ	P	3049
DIVIDE	P	324C	QTABLE	P	332B	RPMTBL	P	335C	BUMP	P	C30D
BUMPN	P	C312	BENTER	P	C2CB	BAA	B	00EF	BUMPT	P	C2F8
HISTOG	P	C1FA	WAIT	P	C2ED						
?EXIT											

APPENDIX B

J-CATCH DATA

SIRS SPECTRUM USAGE				PAGE	1
AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED					
REORDER: 1591 BASE: 1					
DELTA LOG TIME: 0.0 HOURS					
***** INDICATES AN INVALID FLIGHT CONDITION VALUE					
FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIVAL PER 100 HOURS	OCCURRENCE RETRIVAL PFR 100 HOURS		
GUN TURN <.5 VH	TOTAL	0.0	0.0		
1	<7750	0.0	0.0		
2	7750-8750	0.0	0.0		
3	>8750	0.0	0.0		
GUN TURN .5-.7 VH	TOTAL	0.0	0.0		
4	<7750	0.0	0.0		
5	7750-8750	0.0	0.0		
6	>8750	0.0	0.0		
GUN TURN .7-.9 VH	TOTAL	0.0	0.0		
7	<7750	0.0	0.0		
8	7750-8750	0.0	0.0		
9	>8750	0.0	0.0		
GUN TURN >.9 VH	TOTAL	0.0	0.0		
10	<7750	0.0	0.0		
11	7750-8750	0.0	0.0		
12	>8750	0.0	0.0		
GUN S TURN <.5 VH	TOTAL	0.0	0.0		
13	<7750	0.0	0.0		
14	7750-8750	0.0	0.0		
15	>8750	0.0	0.0		
GUN S TURN .5-.7 VH	TOTAL	0.0	0.0		
16	<7750	0.0	0.0		
17	7750-8750	0.0	0.0		
18	>8750	0.0	0.0		
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0		
19	<7750	0.0	0.0		
20	7750-8750	0.0	0.0		
21	>8750	0.0	0.0		
GUN S TURN >.9 VH	TOTAL	0.0	0.0		
22	<7750	0.0	0.0		
23	7750-8750	0.0	0.0		
24	>8750	0.0	0.0		
HOVER <.3 VH	TOTAL	0.0	0.0		
25	<7750	0.0	0.0		
26	7750-8750	0.0	0.0		
27	>8750	0.0	0.0		
CRUISE .3-.5 VH	TOTAL	0.0	0.0		
28	<7750	0.0	0.0		
29	7750-8750	0.0	0.0		
30	>8750	0.0	0.0		

SIRS SPECTRUM USAGE

PAGE 2

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1591 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 10 HOURS
CRUISE .5-.6 VH	TOTAL	0.0	0.0
31	<7750	0.0	0.0
32	7750-8750	0.0	0.0
33	>8750	0.0	0.0
CRUISE .6-.7 VH	TOTAL	0.0	0.0
34	<7750	0.0	0.0
35	7750-8750	0.0	0.0
36	>8750	0.0	0.0
CRUISE .7-.8 VH	TOTAL	0.0	0.0
37	<7750	0.0	0.0
38	7750-8750	0.0	0.0
39	>8750	0.0	0.0
CRUISE .8-.9 VH	TOTAL	0.0	0.0
40	<7750	0.0	0.0
41	7750-8750	0.0	0.0
42	>8750	0.0	0.0
CRUISE .9-1.0 VH	TOTAL	0.0	0.0
43	<7750	0.0	0.0
44	7750-8750	0.0	0.0
45	>8750	0.0	0.0
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0
46	<7750	0.0	0.0
47	7750-8750	0.0	0.0
48	>8750	0.0	0.0
CRUISE >1.1 VH	TOTAL	0.0	0.0
49	<7750	0.0	0.0
50	7750-8750	0.0	0.0
51	>8750	0.0	0.0
CLIMB >.5 VH	TOTAL	0.0	0.0
52	<7750	0.0	0.0
53	7750-8750	0.0	0.0
54	>8750	0.0	0.0
DESCENT >.5 VH	TOTAL	0.0	0.0
55	<7750	0.0	0.0
56	7750-8750	0.0	0.0
57	>8750	0.0	0.0
ACCEL TO CLIMB	TOTAL	0.0	0.0
58	<7750	0.0	0.0
59	7750-8750	0.0	0.0
60	>8750	0.0	0.0

SINS SPECTRUM USAGE

PAGE 3

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1591 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
FLARE			
61	TOTAL		0.
62	<7750		0.
63	7750-8750		0.
	>8750		0.
N2 PEAKS 1.1-1.3 G			
64	TOTAL		0.
65	<7750		0.
66	7750-8750		0.
	>8750		0.
N2 PEAKS 1.3-1.5 G			
67	TOTAL		0.
68	<7750		0.
69	7750-8750		0.
	>8750		0.
N2 PEAKS 1.5-1.7 G			
70	TOTAL		0.
71	<7750		0.
72	7750-8750		0.
	>8750		0.
N2 PEAKS >1.7 G			
73	TOTAL		0.
74	<7750		0.
75	7750-8750		0.
	>8750		0.
ROTOR CYCLES			
244	TOTAL		0.
NORMAL LANDINGS			
245	TOTAL		0.
AUTOROTATIVE LANDGS			
246	TOTAL		0.
FLIGHT TIME			
267	TOTAL	0.0	0.0
268	<7750	0.0	0.0
269	7750-8750	0.0	0.0
	>8750	0.0	0.0
GROUND TIME			
270	TOTAL	4.3	0.0
		4.3	0.0
NORMAL TURN <.5 VH			
271	TOTAL	0.0	0.0
272	<7750	0.0	0.0
273	7750-8750	0.0	0.0
	>8750	0.0	0.0
NORMAL TURN .5-.7 VH			
274	TOTAL	0.0	0.0
275	<7750	0.0	0.0
276	7750-8750	0.0	0.0
	>8750	0.0	0.0

SIRS SPECTRUM USAGE PAGE 4

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1591 BASE: 1
 DPLTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIFVAL PFR 100 HOURS
			RETRIFVAL PER 100 HOURS	
NORMAL TURN 7-.9 VR	TOTAL	0.0	0.0	
277	<7750	0.0	0.0	
278	7750-8750	0.0	0.0	
279	>8750	0.0	0.0	
NORMAL TURN >.9 VR	TOTAL	0.0	0.0	
280	<7750	0.0	0.0	
281	7750-8750	0.0	0.0	
282	>8750	0.0	0.0	
AUTO TURNS NZ<1.5 G	TOTAL	0.0	0.0	
283	<7750	0.0	0.0	
284	7750-8750	0.0	0.0	
285	>8750	0.0	0.0	
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0	
286	<7750	0.0	0.0	
287	7750-8750	0.0	0.0	
288	>8750	0.0	0.0	
AUTOROTATIVE TIME	TOTAL	0.0	0.0	
289	<7750	0.0	0.0	
290	7750-8750	0.0	0.0	
291	>8750	0.0	0.0	
SYMMETRICAL DIVE	TOTAL	0.0	0.0	
292	<7750	0.0	0.0	
293	7750-8750	0.0	0.0	
294	>8750	0.0	0.0	
ASYMMETRICAL DIVE	TOTAL	0.0	0.0	
295	<7750	0.0	0.0	
296	7750-8750	0.0	0.0	
297	>8750	0.0	0.0	
SYMMETRICAL PULLUP	TOTAL	0.0	0.0	
298	<7750	0.0	0.0	
299	7750-8750	0.0	0.0	
300	>8750	0.0	0.0	
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0	
301	<7750	0.0	0.0	
302	7750-8750	0.0	0.0	
303	>8750	0.0	0.0	

SIRS SPECTRUM USAGE

PAGE 5

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 RFASON: SCHEDULED
 REORDER: 1591 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247	RPM	PEAK VALUE	313.1
-----	-----	------------	-------

248	TORQUE PEAK VALUE	2.0
100	100	100
200	200	200
300	300	300
400	400	400
500	500	500
600	600	600
700	700	700
800	800	800
900	900	900
1000	1000	1000

249	VL PEAK VALUE	0.8
-----	---------------	-----

252	VH PEAK VALUE	1.0
-----	---------------	-----

251 DENS ALT PRK VALUE C.0

252	NZ	PEAK	VALUE	2.4
-----	----	------	-------	-----

253	OAT MAXIMUM VALUE	15.5
-----	-------------------	------

254 OAT MINIMUM VALUE -20.0

255 GROSS WEIGHT PEAK 0.0

256 ROLL PEAK VALUE 12.4

DENSITY ALTITUDE HISTOGRAM
ALTITUDE (K FT)

	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIVAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
YIT COND MBS	304	306	307	308	309	310	311	312	313	314	314

RPM HISTOGRAM RPM

	314	319	324	329	334	339	TOTAL
EXTRINQUEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PER COND MES	315	317	318	319	320	321	

TORQUE HISTOGRAM
TORQUE (PSI)

	<10	10	20	30	40	50	TOTAL	
			TORQUE (PSI)					
RETRIVAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PFR 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
VIT COND NBS	322	323	324	325	326	327		

SIRS SPECTRUM USAGE PAGE 6

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1591 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: <10%

AIRSPEED VS TORQUE BY RUDDER POSITION

A/S (VH)	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5							76- 81
PER 100 HRS							
.5							82- 87
PER 100 HRS							
.7							88- 93
PER 100 HRS							
.9							94- 99
PER 100 HRS							
***TOTAL							
PER 100 HRS							

RUDDER POSITION: 10-20%

AIRSPEED VS TORQUE BY RUDDER POSITION

A/S (VH)	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5							100-105
PER 100 HRS							
.5							106-111
PER 100 HRS							
.7							112-117
PER 100 HRS							
.9							118-123
PER 100 HRS							
***TOTAL							
PER 100 HRS							

SIRS SPECTRUM USACP PAGE 7

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1591 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: 20-40% AIRSPEED VS TORQUE BY RUDDER POSITION

A/S (VH)	TORQUE (PSI)	TOTAL	FLIGHT CONDITIONS
<10	10	50	124-129
<.5	20	40	130-135
PER 100 HRS	30	50	136-141
.5	40	50	142-147
PER 100 HRS	50	50	
.7	50	50	
PER 100 HRS	50	50	
.9	50	50	
PER 100 HRS	50	50	
***TOTAL	50	50	
PER 100 HRS	50	50	

RUDDER POSITION: 40-60% AIRSPEED VS TORQUE BY RUDDER POSITION

A/S (VH)	TORQUE (PSI)	TOTAL	FLIGHT CONDITIONS
<10	10	50	148-153
<.5	20	40	154-159
PER 100 HRS	30	50	160-165
.5	40	50	166-171
PER 100 HRS	50	50	
.7	50	50	
PER 100 HRS	50	50	
.9	50	50	
PER 100 HRS	50	50	
***TOTAL	50	50	
PER 100 HRS	50	50	

SIRS SPECTRUM USAGE PAGE 8

AIRCRAFT: 76-22569. LOG TIME: C.C. RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1591 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: 60-80%

AIRSPEED VS TORQUE BY RUDDER POSITION

A/S (VH)	10	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5						172-177
PER 100 HRS						
.5						178-183
PER 100 HRS						
.7						184-189
PER 100 HRS						
.9						190-195
PER 100 HRS						
***TOTAL						
PER 100 HRS						

RUDDER POSITION: 80-90%

AIRSPEED VS TORQUE BY RUDDER POSITION

A/S (VH)	10	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5						196-201
PER 100 HRS						
.5						202-207
PER 100 HRS						
.7						208-213
PER 100 HRS						
.9						214-219
PER 100 HRS						
***TOTAL						
PER 100 HRS						

SIRS SPECTRUM USAGE

PAGE 9

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1591 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE.)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: >90°

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
PER 100 HRS	<.5							220-225
PER 100 HRS	.5							226-231
PER 100 HRS	.7							232-237
PER 100 HRS	.9							238-243
***TOTAL								
PER 100 HRS								

SIRS SPECTRUM USAGE

PAGE 10

AIRCRAFT: 76-22571, LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
GUN TURN <.5 VH	TOTAL	0.0	0.0
1	<750	0.0	0.0
2	7750-8750	0.0	0.0
3	>8750	0.0	0.0
GUN TURN .5-.7 VH	TOTAL	0.0	0.6
4	<7750	0.0	0.0
5	7750-8750	0.0	0.6
6	>8750	0.0	0.0
GUN TURN .7-.9 VH	TOTAL	0.0	0.0
7	<7750	0.0	0.0
8	7750-8750	0.0	0.0
9	>8750	0.0	0.0
GUN TURN >.9 VH	TOTAL	0.0	0.0
10	<7750	0.0	0.0
11	7750-8750	0.0	0.0
12	>8750	0.0	0.0
GUN S TURN <.5 VH	TOTAL	0.0	0.0
13	<7750	0.0	0.0
14	7750-8750	0.0	0.0
15	>8750	0.0	0.0
GUN S TURN .5-.7 VH	TOTAL	0.0	0.0
16	<7750	0.0	0.0
17	7750-8750	0.0	0.0
18	>8750	0.0	0.0
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0
19	<7750	0.0	0.0
20	7750-8750	0.0	0.0
21	>8750	0.0	0.0
GUN S TURN >.9 VH	TOTAL	0.0	0.0
22	<7750	0.0	0.0
23	7750-8750	0.0	0.0
24	>8750	0.0	0.0
HOVER <.3 VH	TOTAL	1.2	35.4
25	<7750	0.1	2.7
26	7750-8750	0.2	6.2
27	>8750	0.9	26.5
CRUISE .3-.5 VH	TOTAL	0.3	8.3
28	<7750	0.1	3.0
29	7750-8750	0.1	3.5
30	>8750	0.1	1.8

AIRCRAFT: 76-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 ***** INDICATES AN INVALID FLIGHT CONDITION VALUE

PAGE 11

SIRS SPECTRUM USAGE

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
CRUISE .5-.6 VH	TOTAL	0.5	15.0
31	<7750	0.2	5.0
32	7750-8750	0.2	6.0
33	>8750	0.1	4.0
CRUISE .6-.7 VH	TOTAL	0.5	13.6
34	<7750	0.2	5.9
35	7750-8750	0.2	5.3
36	>8750	0.1	2.5
CRUISE .7-.8 VH	TOTAL	0.0	0.5
37	<7750	0.0	0.1
38	7750-8750	0.0	0.1
39	>8750	0.0	0.3
CRUISE .8-.9 VH	TOTAL	0.0	0.0
40	<7750	0.0	0.0
41	7750-8750	0.0	0.0
42	>8750	0.0	0.0
CRUISE .9-1.0 VH	TOTAL	0.0	0.0
43	<7750	0.0	0.0
44	7750-8750	0.0	0.0
45	>8750	0.0	0.0
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0
46	<7750	0.0	0.0
47	7750-8750	0.0	0.0
48	>8750	0.0	0.0
CRUISE >1.1 VH	TOTAL	0.0	0.0
49	<7750	0.0	0.0
50	7750-8750	0.0	0.0
51	>8750	0.0	0.0
CLIMB >.5 VH	TOTAL	0.0	0.1
52	<7750	0.0	0.0
53	7750-8750	0.0	0.1
54	>8750	0.0	0.0
DESCENT >.5 VH	TOTAL	0.0	0.5
55	<7750	0.0	0.2
56	7750-8750	0.0	0.1
57	>8750	0.0	0.2
ACCEL TO CLIMB	TOTAL	0.0	0.0
58	<7750	0.0	0.0
59	7750-8750	0.0	0.0
60	>8750	0.0	0.0

S.R.S SPECTRUM USAGE PAGE 12

AIRCRAFT: 76-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
FLARE 61	TOTAL		9.
62	<7750		0.
63	7750-8750		0.
	>8750		9.
NZ PEAKS 1.1-1.3 G	TOTAL		582.
64	<7750		95.
65	7750-8750		107.
66	>8750		380.
NZ PEAKS 1.3-1.5 G	TOTAL		1075.
67	<7750		0.
68	7750-8750		15.
69	>8750		22.
NZ PEAKS 1.5-1.7 G	TOTAL		5.
70	<7750		0.
71	7750-8750		3.
72	>8750		2.
NZ PEAKS >1.7 G	TOTAL		11.
73	<7750		0.
74	7750-8750		4.
75	>8750		7.
ROTOR CYCLES 244	TOTAL		4.
NORMAL LANDINGS 245	TOTAL		11.
AUTOROTATIVE LNDGS 246	TOTAL		11.
FLIGHT TIME 267	TOTAL	3.4	2.
268	<7750	0.6	
269	7750-8750	0.6	
	>8750	1.0	
GROUND TIME 270	TOTAL	1.8	
		0.6	
		0.6	
NORMAL TURN <.5 VH 271	TOTAL	4.4	
272	<7750	0.2	
273	7750-8750	0.0	
	>8750	0.0	
NORMAL TURN .5-.7 VH 274	TOTAL	0.1	
275	<7750	0.1	
276	7750-8750	0.0	
	>8750	0.0	

SIRS SPECTRUM USAGE PAGE 13

AIRCRAFT: 76-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
NORMAL TURN .7-.9 VH	TOTAL	0.0	0.0	
277	<7750	0.0	0.0	
278	7750-8750	0.0	0.0	
279	>8750	0.0	0.0	
NORMAL TURN >.9 VH	TOTAL	0.0	0.0	
280	<7750	0.0	0.0	
281	7750-8750	0.0	0.0	
282	>8750	0.0	0.0	
AUTO TURNS NZ<1.5 G	TOTAL	0.0	1.1	
283	<7750	0.0	0.0	
284	7750-8750	0.0	0.1	
285	>8750	0.0	0.9	
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0	
286	<7750	0.0	0.0	
287	7750-8750	0.0	0.0	
288	>8750	0.0	0.0	
AUTOROTATIVE TIME	TOTAL	0.0	0.3	
289	<7750	0.0	0.1	
290	7750-8750	0.0	0.0	
291	>8750	0.0	0.2	
SYMMETRICAL DIVE	TOTAL	0.0	0.0	
292	<7750	0.0	0.0	
293	7750-8750	0.0	0.0	
294	>8750	0.0	0.0	
ASYMMETRICAL DIVE	TOTAL	0.0	0.0	
295	<7750	0.0	0.0	
296	7750-8750	0.0	0.0	
297	>8750	0.0	0.0	
SYMMETRICAL PULLUP	TOTAL	0.0	0.0	
298	<7750	0.0	0.0	
299	7750-8750	0.0	0.0	
300	>8750	0.0	0.0	
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0	
301	<7750	0.0	0.0	
302	7750-8750	0.0	0.0	
303	>8750	0.0	0.0	

SIMS SPECTRUM USAGE PAGE 14

AIRCRAFT: 76-22571. LOC TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247 RPM PEAK VALUE 333.7
 248 TORQUE PEAK VALUE 54.0
 249 VL PEAK VALUE 0.6
 250 VH PEAK VALUE 0.7
 251 DENS ALT PEAK VALUE 3415.3
 252 NZ PEAK VALUE 2.1
 253 OAT MAXIMUM VALUE 29.0
 254 OAT MINIMUM VALUE 10.0
 255 GROSS WEIGHT PEAK 10400.0
 256 ROLL PEAK VALUE 54.3

DENSITY ALTITUDE HISTOGRAM

	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	<1	0.1	3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	3.4
PER 100 HRS	2.3	4.1	87.9	5.8	0.0	0.0	0.0	0.0	0.0	0.0	100.0
FLT COND MRS	304	305	306	307	308	309	310	311	312	313	314

RPM HISTOGRAM

	314	319	324	329	334	339	TOTAL
RETRIEVAL	0.1	1.6	1.8	0.0	0.0	0.0	3.4
PER 100 HRS	3.4	45.3	51.1	0.3	0.0	0.0	100.0
FLT COND MRS	315	316	317	318	319	320	321

TORQUE HISTOGRAM

	10	20	30	40	50	TOTAL
RETRIEVAL	<10	0.0	0.0	1.1	0.0	3.4
PER 100 HRS	0.3	7.6	23.3	31.8	0.2	100.0
FLT COND MRS	322	323	324	325	326	327

SIRS SPECTRUM USAGE PAGE 15

AIRCRAFT: 70-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
REORDER: 1002 BASE: 1
DELTA LOG TIME: 0.0 HOURS
***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRCRAFT: 70-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
REORDER: 1002 BASE: 1
DELTA LOG TIME: 0.0 HOURS
(***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: <10%

A/S (VH)	<10	10	TORQUE (PSI)	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5								
PER 100 HRS								
.5								76- 81
PER 100 HRS								
.7								82- 87
PER 100 HRS								
.9								88- 93
PER 100 HRS								
***TOTAL								94- 99
PER 100 HRS								

RUDDER POSITION: 10-20%

A/S (WH)	TORQUE (PSI)	FLIGHT CONDITIONS
<.5	10	100-105
PER 100 HRS	20	100-105
.5	30	106-111
PER 100 HRS	40	106-111
.7	50	112-117
PER 100 HRS	60	112-117
.9	70	118-123
PER 100 HRS	80	118-123
***TOTAL	90	118-123
PER 100 HRS	100	118-123

SIRS SPECTRUM USAGE

PAGE 16

AIRCRAFT: 76-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: 20-40%		AIRSPEED VS TORQUE BY RUDDER POSITION					FLIGHT CONDITIONS
A/S (VH)	<10	10	20	30	40	50	
<.5			0.0	0.1	0.8	0.0	0.9
PER 100 HRS			0.0	3.0	22.8	0.1	25.9
.5							130-135
PER 100 HRS							136-141
.7							142-147
PER 100 HRS							
.9							
PER 100 HRS							
***TOTAL			0.0	0.1	0.8	0.0	0.9
PER 100 HRS			0.0	3.0	22.8	0.1	25.9

RUDDER POSITION: 40-60%		AIRSPEED VS TORQUE BY RUDDER POSITION					FLIGHT CONDITIONS
A/S (VH)	<10	10	20	30	40	50	
<.5	0.0	0.1	0.1	0.2	0.1	0.0	0.5
PER 100 HRS	0.1	4.0	2.0	5.5	3.4	0.1	15.1
.5		0.0	0.0	0.0	0.1	0.0	0.1
PER 100 HRS	0.0	0.0	0.0	0.6	1.6	0.0	2.2
.7					0.0		0.0
PER 100 HRS					0.1		0.1
.9							
PER 100 HRS							
***TOTAL	0.0	0.1	0.1	0.2	0.2	0.0	0.6
PER 100 HRS	0.1	4.0	2.0	6.1	5.1	0.1	17.4

SIRS SPECTRUM USAGE PAGE 17

AIRCRAFT: 76-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1902 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION									
RUDDER POSITION: 60-80%									
A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS	
<.5	0.0	0.1	0.5	0.2	0.0		0.8	172-177	
PER 100 HRS	0.2	3.3	13.9	4.4	0.5		22.2		
.5		0.0	0.3	0.6	0.3		1.2	178-183	
PER 100 HRS		0.2	7.3	18.1	8.1		33.7		
.7				0.0	0.0		0.0	184-189	
PER 100 HRS				0.2	0.4		0.5		
.9								190-195	
PER 100 HRS									
***TOTAL	0.0	0.1	0.7	0.8	0.3		1.9		
PER 100 HRS	0.2	3.4	21.2	22.7	9.0		56.4		

AIRSPEED VS TORQUE BY RUDDER POSITION									
RUDDER POSITION: 80-90%									
A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS	
<.5	0.0	0.0	0.0	0.0	0.0		0.0	196-201	
PER 100 HRS	0.0	0.1	0.1	0.0	0.0		0.2		
.5		0.0	0.0	0.0	0.0		0.0	202-207	
PER 100 HRS		0.0	0.0	0.0	0.0		0.0		
.7								208-213	
PER 100 HRS									
.9								214-219	
PER 100 HRS									
***TOTAL	0.0	0.0	0.0	0.0	0.0		0.0		
PER 100 HRS	0.0	0.1	0.1	0.0	0.0		0.3		

SIRS SPECTRUM USAGE PAGE 18

AIRCRAFT: 76-22571. LOG TIME: 0.0 RETRIEVAL DATE: 21/ 3/79 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: >90%		AIRSPEED VS TORQUE BY RUDDER POSITION				
A/S (VH)	<10	10	20	30	40	50
TORQUE (PSI)						
<.5			0.0	0.0		
PER 100 HRS			0.0	0.0		
.5		0.0				
PER 100 HRS		0.0				
.7						
PER 100 HRS						
.9						
PER 100 HRS						
***TOTAL		0.0	0.0	0.0		
PER 100 HRS		0.0	0.0	0.0		
TOTAL						
						0.0
						0.0
FLIGHT CONDITIONS						
						220-225
						226-231
						232-237
						238-243

SIRS SPECTRUM USAGE

AIRCRAFT: 76-22574, LOG TIME: 0.0 RPTRIIVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RPTRIIVAL PFR 100 HOURS
		RPTRIIVAL	PER 100 HOURS	
GUN TURN <.5 VH				
1	TOTAL	0.0	0.0	0.0
2	<7750	0.0	0.0	0.0
3	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
GUN TURN .5-.7 VH				
4	TOTAL	0.0	0.0	0.0
5	<7750	0.0	0.0	0.0
6	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
GUN TURN .7-.9 VH				
7	TOTAL	0.0	0.0	0.0
8	<7750	0.0	0.0	0.0
9	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
GUN TURN >.9 VH				
10	TOTAL	0.0	0.0	0.0
11	<7750	0.0	0.0	0.0
12	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
GUN S TURN <.5 VH				
13	TOTAL	0.0	0.0	0.0
14	<7750	0.0	0.0	0.0
15	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
GUN S TURN .5-.7 VH				
16	TOTAL	0.0	1.2	1.2
17	<7750	0.0	1.2	1.2
18	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
GUN S TURN .7-.9 VH				
19	TOTAL	0.0	0.0	0.0
20	<7750	0.0	0.0	0.0
21	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
GUN S TURN >.9 VH				
22	TOTAL	0.0	0.0	0.0
23	<7750	0.0	0.0	0.0
24	7750-8750	0.0	0.0	0.0
	>8750	0.0	0.0	0.0
HOVER <.3 VH				
25	TOTAL	0.0	37.2	37.2
26	<7750	0.0	24.7	24.7
27	7750-8750	0.0	10.5	10.5
	>8750	0.0	2.0	2.0
CRUISE .3-.5 VH				
28	TOTAL	0.2	7.0	7.0
29	<7750	0.2	7.1	7.1
30	7750-8750	0.0	0.2	0.2
	>8750	0.0	0.0	0.0

SIRS SPECTRUM USAGE PAGE 20

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDFR: 1005 BASF: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
CRUISE .5-.6 VH	TOTAL	0.5	19.9
31	<7750	0.5	19.9
32	7750-8750	0.0	0.0
33	>8750	0.0	0.0
CRUISE .6-.7 VH	TOTAL	0.4	16.2
34	<7750	0.4	16.2
35	7750-8750	0.0	0.0
36	>8750	0.0	0.0
CRUISE .7-.8 VH	TOTAL	0.1	2.9
37	<7750	0.1	2.9
38	7750-8750	0.0	0.0
39	>8750	0.0	0.0
CRUISE .8-.9 VH	TOTAL	0.0	0.0
40	<7750	0.0	0.0
41	7750-8750	0.0	0.0
42	>8750	0.0	0.0
CRUISE .9-1.0 VH	TOTAL	0.0	0.0
43	<7750	0.0	0.0
44	7750-8750	0.0	0.0
45	>8750	0.0	0.0
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0
46	<7750	0.0	0.0
47	7750-8750	0.0	0.0
48	>8750	0.0	0.0
CRUISE >1.1 VH	TOTAL	0.0	0.0
49	<7750	0.0	0.0
50	7750-8750	0.0	0.0
51	>8750	0.0	0.0
CLIMB >.5 VH	TOTAL	0.0	0.2
52	<7750	0.0	0.2
53	7750-8750	0.0	0.0
54	>8750	0.0	0.0
DESCENT >.5 VH	TOTAL	0.0	0.1
55	<7750	0.0	0.1
56	7750-8750	0.0	0.0
57	>8750	0.0	0.0
ACCEL TO CLIMB	TOTAL	0.0	0.0
58	<7750	0.0	0.0
59	7750-8750	0.0	0.0
60	>8750	0.0	0.0

SIRS SPECTRUM USAGE PAGE 21

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 RFASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PFR 100 HOURS
FLARE	TOTAL		0.
61	<7750		0.
62	7750-8750		0.
63	>8750		0.
NZ PEAKS 1.1-1.3 G	TOTAL		252.
64	<7750		244.
65	7750-8750		8.
66	>8750		0.
NZ PEAKS 1.3-1.5 G	TOTAL		13.
67	<7750		13.
68	7750-8750		0.
69	>8750		0.
NZ PFAKS 1.5-1.7 G	TOTAL		6.
70	<7750		6.
71	7750-8750		0.
72	>8750		0.
NZ PEAKS >1.7 G	TOTAL		2.
73	<7750		2.
74	7750-8750		0.
75	>8750		0.
ROTOR CYCLES	TOTAL		8.
244			8.
NORMAL LANDINGS	TOTAL		19.
245			19.
AUTOROTATIVE LNDGS	TOTAL		6.
246			6.
FLIGHT TIME	TOTAL	2.3	100.0
267	<7750	2.0	86.4
268	7750-8750	0.3	11.7
269	>8750	0.0	2.0
GROUND TIME	TOTAL	1.3	59.0
270		1.3	59.0
NORMAL TURN <.5 VB	TOTAL	0.0	0.0
271	<7750	0.0	0.0
272	7750-8750	0.0	0.0
273	>8750	0.0	0.0
NORMAL TURN .5-.7 VB	TOTAL	0.0	0.4
274	<7750	0.0	0.4
275	7750-8750	0.0	0.0
276	>8750	0.0	0.0

SIRS SPECTRUM USAGE PAGE 22

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE	
		RETRIEVAL	PER 100 HOURS	RETRIEVAL	PER 100 HOURS
NORMAL TURN .7-.9 VH	TOTAL	0.0	0.0	0.0	0.0
277	<7750	0.0	0.0	0.0	0.0
278	7750-8750	0.0	0.0	0.0	0.0
279	>8750	0.0	0.0	0.0	0.0
NORMAL TURN >.9 VH	TOTAL	0.0	0.0	0.0	0.0
280	<7750	0.0	0.0	0.0	0.0
281	7750-8750	0.0	0.0	0.0	0.0
282	>8750	0.0	0.0	0.0	0.0
AUTO TURNS NZ<1.5 G	TOTAL	0.0	0.1	0.0	0.1
283	<7750	0.0	0.1	0.0	0.1
284	7750-8750	0.0	0.0	0.0	0.0
285	>8750	0.0	0.0	0.0	0.0
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0	0.0	0.0
286	<7750	0.0	0.0	0.0	0.0
287	7750-8750	0.0	0.0	0.0	0.0
288	>8750	0.0	0.0	0.0	0.0
AUTOROTATIVE TIME	TOTAL	0.0	0.0	0.0	0.0
289	<7750	0.0	0.0	0.0	0.0
290	7750-8750	0.0	0.0	0.0	0.0
291	>8750	0.0	0.0	0.0	0.0
SYMMETRICAL DIVE	TOTAL	0.0	0.0	0.0	0.0
292	<7750	0.0	0.0	0.0	0.0
293	7750-8750	0.0	0.0	0.0	0.0
294	>8750	0.0	0.0	0.0	0.0
ASYMMETRICAL DIVE	TOTAL	0.0	0.0	0.0	0.0
295	<7750	0.0	0.0	0.0	0.0
296	7750-8750	0.0	0.0	0.0	0.0
297	>8750	0.0	0.0	0.0	0.0
SYMMETRICAL PULLUP	TOTAL	0.0	0.0	0.0	0.0
298	<7750	0.0	0.0	0.0	0.0
299	7750-8750	0.0	0.0	0.0	0.0
300	>8750	0.0	0.0	0.0	0.0
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0	0.0	0.0
301	<7750	0.0	0.0	0.0	0.0
302	7750-8750	0.0	0.0	0.0	0.0
303	>8750	0.0	0.0	0.0	0.0

SIMS SPECTRUM USAGE

PAGE 23

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247 RPM PEAK VALUE 360.0
 248 TORQUE PEAK VALUE 47.0
 249 VL PEAK VALUE 0.6
 250 VH PEAK VALUE 0.8
 251 DFMS ALT PEAK VALUE 2502.3
 252 WZ PEAK VALUE 2.0
 253 OAT MAXIMUM VALUE 23.5
 254 OAT MINIMUM VALUE 15.5
 255 GROSS WEIGHT PEAK 9600.0
 256 ROLL PEAK VALUE 58.4

DENSITY ALTITUDE HISTOGRAM

	<1	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	0.0	1.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
PER 100 HRS	0.0	58.3	41.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
FLT COND MRS	504	305	306	307	308	309	310	311	312	313	314	

RPM HISTOGRAM

	<314	314	319	324	329	334	339	TOTAL
RETRIEVAL	0.0	2.1	0.1	0.0	0.0	0.0	0.0	2.3
PER 100 HRS	0.0	94.0	6.0	0.0	0.0	0.0	0.0	100.0
FLT COND MRS	315	316	317	318	319	320	321	

TORQUE HISTOGRAM

	<10	10	20	30	40	50	TOTAL
RETRIEVAL	0.0	0.1	0.9	1.1	0.1	0.0	2.3
PER 100 HRS	0.7	6.3	39.8	49.5	3.7	0.0	100.0
FLT COND MRS	322	323	324	325	326	327	

TECHNOLOGY INC DAYTON OHIO

F/G 14/3

STRUCTURAL INTEGRITY RECORDING SYSTEM (SIRS) FOR U.S. ARMY AH-1--ETC(U)
MAR 81 J G DOTSON, A W KOLB DAAJ02-77-C-0079

MAR 81 J G DOTSON, A W KOLB

DAAJ02-77-C-0079

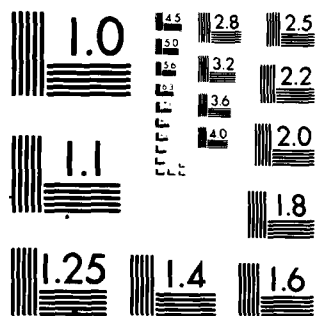
USAAVRADCOM-TR-81-D-6

NL

UNCLASSIFIED

3

END
DATE
FILMED
5-84
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SIRS SPECTRUM USAGE

PAGE 24

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDED: 1005 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: <10°

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5				0.0	0.0		0.0	76- 81
PER 100 HRS				0.1	0.0		0.1	
.5								82- 87
PER 100 HRS								
.7								88- 93
PER 100 HRS								
.9								94- 99
PER 100 HRS								
***TOTAL				0.0	0.0		0.0	
PER 100 HRS				0.1	0.0		0.1	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 10-20°

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5				0.0	0.0		0.0	100-105
PER 100 HRS				0.6	0.3		0.9	
.5								106-111
PER 100 HRS								
.7								112-117
PER 100 HRS								
.9								118-123
PER 100 HRS								
***TOTAL				0.0	0.0		0.0	
PER 100 HRS				0.6	0.3		0.9	

SINS SPECTRUM USAGE

PAGE 25

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1985 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 20-40X

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5		0.0	0.1	0.6	0.1			124-129
PER 100 HRS		0.5	2.4	20.2	2.4		33.4	
.5								130-135
PER 100 HRS								
.7								136-141
PER 100 HRS								
.9								142-147
PER 100 HRS								
***TOTAL		0.0	0.1	0.6	0.1		0.8	
PER 100 HRS		0.5	2.4	20.2	2.4		33.4	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 40-60X

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5		0.0	0.2	0.1	0.0		0.3	148-153
PER 100 HRS		0.0	0.2	2.6	0.0		11.9	
.5		0.0	0.4	0.3	0.0		0.7	154-159
PER 100 HRS		0.1	16.0	14.1	0.4		31.0	
.7			0.0	0.1	0.0		0.1	160-165
PER 100 HRS			0.1	3.0	0.5		3.6	
.9								166-171
PER 100 HRS								
***TOTAL		0.0	0.6	0.4	0.0		1.1	
PER 100 HRS		1.5	25.2	19.7	0.9		47.4	

SIRS SPECTRUM USAGE

PAGE 26

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDYN: 1005 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 60-80%

A/S (VR)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.0	0.1	0.1	0.0			0.2	172-177
PER 100 HRS	0.5	3.0	2.0	0.2			6.7	
.5	0.0	0.0	0.2	0.0	0.0		0.3	178-183
PER 100 HRS	0.1	1.2	0.2	0.7	0.0		11.2	
.7			0.0	0.0	0.0		0.0	184-189
PER 100 HRS			0.0	0.1	0.0		0.1	
.9								190-195
PER 100 HRS								
***TOTAL	0.0	0.1	0.3	0.0	0.0		0.4	
PER 100 HRS	0.6	4.2	12.2	1.0	0.0		18.0	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 80-90%

A/S (VR)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5		0.0	0.0				0.0	196-201
PER 100 HRS		0.1	0.0				0.1	
.5			0.0				0.0	202-207
PER 100 HRS			0.0				0.0	
.7								208-213
PER 100 HRS								
.9								214-219
PER 100 HRS								
***TOTAL		0.0	0.0				0.0	
PER 100 HRS		0.1	0.0				0.1	

AIRCRAFT: 76-22574. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

SIRS SPECTRUM USAGE

PAGE 27

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: >90X

A/S (VR)	<10	10	TORQUE (PSI)	20	30	40	50	TOTAL	FLIGHT CONDITIONS
PER 100 HRS	<.5								220-225
PER 100 HRS	.5								226-231
PER 100 HRS	.7								232-237
PER 100 HRS	.9								238-243
***TOTAL									
PER 100 HRS									

SIRS SPECTRUM USAGE PAGE 28

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1603 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (----- INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
GUN TURN <.5 VH	TOTAL	0.0	0.0
1	<7750	0.0	0.0
2	7750-8750	0.0	0.0
3	>8750	0.0	0.0
GUN TURN .5-.7 VH	TOTAL	0.0	0.1
4	<7750	0.0	0.0
5	7750-8750	0.0	0.1
6	>8750	0.0	0.0
GUN TURN .7-.9 VH	TOTAL	0.0	0.0
7	<7750	0.0	0.0
8	7750-8750	0.0	0.0
9	>8750	0.0	0.0
GUN TURN >.9 VH	TOTAL	0.0	0.0
10	<7750	0.0	0.0
11	7750-8750	0.0	0.0
12	>8750	0.0	0.0
GUN S TURN <.5 VH	TOTAL	0.0	0.0
13	<7750	0.0	0.0
14	7750-8750	0.0	0.0
15	>8750	0.0	0.0
GUN S TURN .5-.7 VH	TOTAL	0.0	0.0
16	<7750	0.0	0.0
17	7750-8750	0.0	0.0
18	>8750	0.0	0.0
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0
19	<7750	0.0	0.0
20	7750-8750	0.0	0.0
21	>8750	0.0	0.0
GUN S TURN >.9 VH	TOTAL	0.0	0.0
22	<7750	0.0	0.0
23	7750-8750	0.0	0.0
24	>8750	0.0	0.0
HOVER <.3 VH	TOTAL	1.2	41.0
25	<7750	0.3	8.7
26	7750-8750	0.5	16.7
27	>8750	0.5	15.5
CRUISE .3-.5 VH	TOTAL	0.3	10.0
28	<7750	0.0	1.1
29	7750-8750	0.2	6.4
30	>8750	0.1	3.4

SIRS SPECTRUM USAGE

PAGE 29

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1983 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (----- INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
CRUISE .5-.6 VH	TOTAL	0.5	17.6	
31	<7750	0.0	1.5	
32	7750-8750	0.2	5.3	
33	>8750	0.3	10.7	
CRUISE .6-.7 VH	TOTAL	0.4	12.4	
34	<7750	0.0	1.3	
35	7750-8750	0.1	3.4	
36	>8750	0.2	7.6	
CRUISE .7-.8 VH	TOTAL	0.0	0.0	
37	<7750	0.0	0.0	
38	7750-8750	0.0	0.0	
39	>8750	0.0	0.0	
CRUISE .8-.9 VH	TOTAL	0.0	0.0	
40	<7750	0.0	0.0	
41	7750-8750	0.0	0.0	
42	>8750	0.0	0.0	
CRUISE .9-1.0 VH	TOTAL	0.0	0.0	
43	<7750	0.0	0.0	
44	7750-8750	0.0	0.0	
45	>8750	0.0	0.0	
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0	
46	<7750	0.0	0.0	
47	7750-8750	0.0	0.0	
48	>8750	0.0	0.0	
CRUISE >1.1 VH	TOTAL	0.0	0.0	
49	<7750	0.0	0.0	
50	7750-8750	0.0	0.0	
51	>8750	0.0	0.0	
CLIMB >.5 VH	TOTAL	0.0	0.3	
52	<7750	0.0	0.0	
53	7750-8750	0.0	0.0	
54	>8750	0.0	0.2	
DESCENT >.5 VH	TOTAL	0.0	0.5	
55	<7750	0.0	0.0	
56	7750-8750	0.0	0.3	
57	>8750	0.0	0.2	
ACCEL TO CLIMB	TOTAL	0.0	0.0	
58	<7750	0.0	0.0	
59	7750-8750	0.0	0.0	
60	>8750	0.0	0.0	

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

SIDS SPECTRUM USAGE PAGE 30

FLIGHT CONDITION	CROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
FLARE	TOTAL		0.
61	<7750		0.
62	7750-8750		0.
63	>8750		0.
NZ PEAKS 1.1-1.3 G	TOTAL		166.
64	<7750		23.
65	7750-8750		82.
66	>8750		61.
NZ PEAKS 1.3-1.5 G	TOTAL		16.
67	<7750		1.
68	7750-8750		5.
69	>8750		10.
NZ PEAKS 1.5-1.7 G	TOTAL		2.
70	<7750		0.
71	7750-8750		2.
72	>8750		0.
NZ PEAKS >1.7 G	TOTAL		0.
73	<7750		0.
74	7750-8750		0.
75	>8750		0.
ROTOR CYCLES	TOTAL		7.
244			7.
NORMAL LANDINGS	TOTAL		7.
245			7.
AUTOROTATIVE LANDGS	TOTAL		4.
246			4.
FLIGHT TIME	TOTAL	100.0	
267	<7750	15.2	
268	7750-8750	39.3	
269	>8750	45.5	
GROUND TIME	TOTAL	16.8	
270		16.8	
NORMAL TURN <.5 VH	TOTAL	1.4	
271	<7750	0.2	
272	7750-8750	0.8	
273	>8750	0.4	
NORMAL TURN .5-.7 VH	TOTAL	2.9	
274	<7750	0.0	
275	7750-8750	1.4	
276	>8750	1.5	

SINS SPECTRUM USAGE

PAGE 31

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	CROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
NORMAL TURN .7-.9 VH	TOTAL	0.0	0.0
277	<7750	0.0	0.0
278	7750-8750	0.0	0.0
279	>8750	0.0	0.0
NORMAL TURN >.9 VH	TOTAL	0.0	0.0
282	<7750	0.0	0.0
281	7750-8750	0.0	0.0
282	>8750	0.0	0.0
AUTO TURNS NZ<1.5 G	TOTAL	0.0	0.0
283	<7750	0.0	0.0
284	7750-8750	0.0	0.0
285	>8750	0.0	0.0
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0
286	<7750	0.0	0.0
287	7750-8750	0.0	0.0
288	>8750	0.0	0.0
AUTOROTATIVE TIME	TOTAL	0.0	0.1
289	<7750	0.0	0.1
290	7750-8750	0.0	0.0
291	>8750	0.0	0.0
SYMMETRICAL DIVE	TOTAL	0.0	0.0
292	<7750	0.0	0.0
293	7750-8750	0.0	0.0
294	>8750	0.0	0.0
ASYMMETRICAL DIVE	TOTAL	0.0	0.0
295	<7750	0.0	0.0
296	7750-8750	0.0	0.0
297	>8750	0.0	0.0
SYMMETRICAL PULLUP	TOTAL	0.0	0.0
298	<7750	0.0	0.0
299	7750-8750	0.0	0.0
300	>8750	0.0	0.0
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0
301	<7750	0.0	0.0
302	7750-8750	0.0	0.0
303	>8750	0.0	0.0

AIRCRAFT: 76-22568. LOG TIME:
RECORDER: 1003 BASE: 1
DELTA LOG TIME: 0.0 HOURS

247	BPM PEAK VALUE	366.3
248	TORQUE PEAK VALUE	58.0
249	VL PEAK VALUE	0.6
250	VH PEAK VALUE	0.7
251	DPNS ALT PEAK VALUE	2748.9
252	M2 PEAK VALUE	1.6
253	OAT MAXIMUM VALUE	23.0
254	OAT MINIMUM VALUE	15.0
255	GROSS WEIGHT PEAK	10902.0
256	ROLL PEAK VALUE	52.1

DENSITY ALTITUDE HISTOGRAM
ALTITUDE (K FT)

	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
PER 100 HRS	0.0	57.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
YLT COND HRS	394	366	387	308	369	311	312	313	314	314	

RPM HISTOGRAM

	314	319	324	329	334	339	TOTAL
RETRIEVAL	0.6	2.4	0.0	0.0	0.0	0.0	3.0
PER 100 HRS	19.9	79.0	1.0	0.0	0.0	0.0	102.0
FLT COND HRS	315	316	317	318	319	320	

**TORQUE HISTOGRAM
TORQUE (PSI)**

	<10	10	20	30	40	50	TOTAL
RETRIEVAL	0.0	0.1	0.7	1.1	0.9	0.2	3.0
PER 100 FRS	0.1	4.1	22.6	35.5	30.6	7.1	100.0
YTC COND WBS	322	323	324	325	326	327	

SIRS SPECTRUM USAGE

PAGE 33

AIRCRAFT: 76-22568. LOG TIME: 8.0 RETRIEVAL DATE: 22/ 3/78 REASON: SCHEDULED
 RECORDER: 1663 BASE: 1
 DELTA LOG TIME: 8.0 HOURS
 (----- INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: <10%

A/S (VH)	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5				0.0	0.0	0.0	76- 81
PER 100 HRS				0.0	0.0	0.0	
.5							82- 87
PER 100 HRS							
.7							88- 93
PER 100 HRS							
.9							94- 99
PER 100 HRS							
***TOTAL				0.0	0.0	0.0	
PER 100 HRS				0.0	0.0	0.0	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 10-20%

A/S (VH)	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5			0.0	0.0	0.0	0.0	100-105
PER 100 HRS			0.0	0.7	0.2	1.0	
.5							106-111
PER 100 HRS							
.7							112-117
PER 100 HRS							
.9							118-123
PER 100 HRS							
***TOTAL			0.0	0.0	0.0	0.0	
PER 100 HRS			0.0	0.7	0.2	1.0	

SIMS SPECTRUM USAGE PAGE 34

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION						
RUDDER POSITION: 20-40%						
A/S (VH)	10	20	30	40	50	FLIGHT CONDITIONS
<.5	0.0	0.0	0.2	0.7	0.0	124-129
PER 100 HRS	0.0	0.1	5.0	22.9	0.8	28.8
.5						130-135
PER 100 HRS						
.7						136-141
PER 100 HRS						
.9						142-147
PER 100 HRS						
***TOTAL	0.0	0.0	0.2	0.7	0.0	0.9
PER 100 HRS	0.0	0.1	5.3	22.9	0.8	28.8

AIRSPEED VS TORQUE BY RUDDER POSITION						
RUDDER POSITION: 40-60%						
A/S (VH)	10	20	30	40	50	FLIGHT CONDITIONS
<.5	0.0	0.2	0.2	0.1	0.0	148-153
PER 100 HRS	0.1	5.6	7.8	2.2	0.2	17.0
.5		0.0	0.5	0.1	0.2	154-159
PER 100 HRS		1.0	15.3	4.0	5.7	25.9
.7			0.0			160-165
PER 100 HRS			0.1			0.1
.9						166-171
PER 100 HRS						
***TOTAL	0.0	0.2	0.7	0.2	0.2	1.3
PER 100 HRS	0.1	6.7	23.1	6.1	5.8	43.0

SINS SPECTRUM USAGE

PAGE 35

AIRCRAFT: 76-22569. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: 60-80%

A/S (VH)	AIRSPEED VS TORQUE BY RUDDER POSITION					TOTAL	FLIGHT CONDITIONS
	<10	10	20	30	40		
<.5	0.0	0.1	0.3	0.1	0.0	0.0	0.5
PER 100 HRS	0.0	2.8	10.8	3.8	0.2	0.0	17.6
.5		0.0	0.2	0.1	0.0	0.0	0.3
PER 100 HRS		0.0	5.0	3.6	0.6	0.2	9.4
.7							184-189
PER 100 HRS							190-195
.9							
PER 100 HRS							
***TOTAL	0.0	0.1	0.5	0.2	0.0	0.0	0.8
PER 100 HRS	0.0	2.8	15.8	7.4	0.8	0.2	27.0

RUDDER POSITION: 80-90%

A/S (VH)	AIRSPEED VS TORQUE BY RUDDER POSITION					TOTAL	FLIGHT CONDITIONS
	<10	10	20	30	40		
<.5	0.0	0.0	0.0				0.0
PER 100 HRS	0.0	0.1	0.1				0.2
.5							202-207
PER 100 HRS							208-213
.7							214-219
PER 100 HRS							
.9							
PER 100 HRS							
***TOTAL	0.0	0.0	0.0				0.0
PER 100 HRS	0.0	0.1	0.1				0.2

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 22/ 3/79 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

SIRS SPECTRUM USAGE PAGE 36

AIRSPEED VS TORQUE BY RUDDER POSITION							
RUDDER POSITION: >90°							
A/S (VH)	10	TORQUE (PSI)		30	40	50	FLIGHT CONDITIONS
<.5	<10		20				220-225
PER 100 HRS	0.0					0.0	0.0
PER 100 HRS	.5						226-231
PER 100 HRS	.7						232-237
PER 100 HRS	.9						238-243
***TOTAL	0.0						0.0
PER 100 HRS	0.0						0.0

APPENDIX C

COMPLETE SIRS SPECTRUM USAGE DATA FOR JUNE 1980

SIRS SPECTRUM USAGE				PAGE 1
AIRCRAFT: 76-22570. LOG TIME: 680.7 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED				
RECORDED: 1007 BASE: 2				
DELTA LOG TIME: 12.8 HOURS				
(***** INDICATES AN INVALID FLIGHT CONDITION VALUE)				
FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS	
GUN TURN <.5 VH	TOTAL	0.0	0.1	
1	<7750	0.0	0.0	
2	7750-8750	0.0	0.1	
3	>8750	0.0	0.0	
GUN TURN .5-.7 VH	TOTAL	0.0	0.3	
4	<7750	0.0	0.0	
5	7750-8750	0.0	0.3	
6	>8750	0.0	0.0	
GUN TURN .7-.9 VH	TOTAL	0.0	0.0	
7	<7750	0.0	0.0	
8	7750-8750	0.0	0.0	
9	>8750	0.0	0.0	
GUN TURN >.9 VH	TOTAL	0.0	0.0	
10	<7750	0.0	0.0	
11	7750-8750	0.0	0.0	
12	>8750	0.0	0.0	
GUN S TURN <.5 VH	TOTAL	0.0	0.0	
13	<7750	0.0	0.0	
14	7750-8750	0.0	0.0	
15	>8750	0.0	0.0	
GUN S TURN .5-.7 VH	TOTAL	0.1	1.0	
16	<7750	0.0	0.0	
17	7750-8750	0.1	1.0	
18	>8750	0.0	0.0	
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0	
19	<7750	0.0	0.0	
20	7750-8750	0.0	0.0	
21	>8750	0.0	0.0	
GUN S TURN >.9 VH	TOTAL	0.0	0.0	
22	<7750	0.0	0.0	
23	7750-8750	0.0	0.0	
24	>8750	0.0	0.0	
BOYER <.3 VH	TOTAL	1.2	12.6	
25	<7750	0.0	0.0	
26	7750-8750	1.2	12.6	
27	>8750	0.0	0.0	
CRUISE .3-.5 VH	TOTAL	0.4	4.2	
28	<7750	0.0	0.0	
29	7750-8750	0.4	4.2	
30	>8750	0.0	0.0	

SIRS SPECTRUM USAGE PAGE 2

AIRCRAFT: 76-22570. LOG TIME: 680.7 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1997 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
CRUISE .5-.6 VH				
TOTAL		1.3	13.3	
<7750		0.0	0.0	
7750-8750		1.3	13.0	
>8750		0.0	0.0	
CRUISE .6-.7 VH				
TOTAL		2.2	22.5	
<7750		0.0	0.0	
7750-8750		2.2	22.5	
>8750		0.0	0.0	
CRUISE .7-.8 VH				
TOTAL		0.6	6.2	
<7750		0.0	0.0	
7750-8750		0.6	6.2	
>8750		0.0	0.0	
CRUISE .8-.9 VH				
TOTAL		0.0	0.0	
<7750		0.0	0.0	
7750-8750		0.0	0.0	
>8750		0.0	0.0	
CRUISE .9-1.0 VH				
TOTAL		0.0	0.0	
<7750		0.0	0.0	
7750-8750		0.0	0.0	
>8750		0.0	0.0	
CRUISE 1.0-1.1 VH				
TOTAL		0.0	0.0	
<7750		0.0	0.0	
7750-8750		0.0	0.0	
>8750		0.0	0.0	
CRUISE >1.1 VH				
TOTAL		0.0	0.0	
<7750		0.0	0.0	
7750-8750		0.0	0.0	
>8750		0.0	0.0	
CLIMB >.5 VH				
TOTAL		0.2	2.0	
<7750		0.0	0.0	
7750-8750		0.2	2.0	
>8750		0.0	0.0	
DESCENT >.5 VH				
TOTAL		0.4	3.7	
<7750		0.0	0.0	
7750-8750		0.4	3.7	
>8750		0.0	0.0	
ACCEL TO CLIMB				
TOTAL		0.0	0.1	
<7750		0.0	0.0	
7750-8750		0.0	0.1	
>8750		0.0	0.0	

SIR'S SPECTRUM USAGE PAGE 3

AIRCRAFT: 76-22570. LOG TIME: 680.7 RETRIEVAL DATE: 20/ 6/88 REASON: SCHEDULED
 RECORDER: 1997 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
FLARE	TOTAL			1.
61	<7750			0.
62	7750-8750			1.
63	>8750			0.
N2 PEAKS 1.1-1.3 G	TOTAL			1840.
64	<7750			0.
65	7750-8750			1840.
66	>8750			0.
N2 PEAKS 1.3-1.5 G	TOTAL			54.
67	<7750			0.
68	7750-8750			54.
69	>8750			0.
N2 PEAKS 1.5-1.7 G	TOTAL			13.
70	<7750			0.
71	7750-8750			13.
72	>8750			0.
N2 PEAKS >1.7 G	TOTAL			7.
73	<7750			0.
74	7750-8750			7.
75	>8750			0.
ROTOR CYCLES	TOTAL			35.
244				35.
NORMAL LANDINGS	TOTAL			55.
245				55.
AUTOROTATIVE LANDGS	TOTAL			49.
246				49.
FLIGHT TIME	TOTAL	9.6	100.0	
267	<7750	0.0	0.0	
268	7750-8750	9.6	100.0	
269	>8750	0.0	0.0	
GROUND TIME	TOTAL	2.3	24.0	
270		2.3	24.0	
NORMAL TURN <.5 VE	TOTAL	0.0	0.2	
271	<7750	0.0	0.0	
272	7750-8750	0.0	0.2	
273	>8750	0.0	0.0	
NORMAL TURN .5-.7 VE	TOTAL	0.2	2.0	
274	<7750	0.0	0.0	
275	7750-8750	0.2	2.0	
276	>8750	0.0	0.0	

SIRS SPECTRUM USAGE PAGE 4

AIRCRAFT: 76-22570. LOG TIME: 680.7 RETRIEVAL DATE: 20/ 6/88 REASON: SCHEDULED
 RECORDER: 1807 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL PER 100 HOURS	RETRIEVAL PER 100 HOURS	
NORMAL TURN .7-.9 VE	TOTAL	2.0	0.3	
277	<7750	0.0	0.0	
278	7750-8750	0.0	0.3	
279	>8750	0.0	0.0	
NORMAL TURN >.9 VE	TOTAL	0.0	0.0	
280	<7750	0.0	0.0	
281	7750-8750	0.0	0.0	
282	>8750	0.0	0.0	
AUTO TURNS NZ<1.5 G	TOTAL	0.1	0.8	
283	<7750	0.0	0.0	
284	7750-8750	0.1	0.8	
285	>8750	0.0	0.0	
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0	
286	<7750	0.0	0.0	
287	7750-8750	0.0	0.0	
288	>8750	0.0	0.0	
AUTOROTATIVE TIME	TOTAL	0.7	6.8	
289	<7750	0.0	0.0	
290	7750-8750	2.7	6.8	
291	>8750	0.0	0.0	
SYMMETRICAL DIVE	TOTAL	0.0	0.0	
292	<7750	0.0	0.0	
293	7750-8750	0.0	0.0	
294	>8750	0.0	0.0	
ASYMMETRICAL DIVE	TOTAL	0.0	0.0	
295	<7750	0.0	0.0	
296	7750-8750	0.0	0.0	
297	>8750	0.0	0.0	
SYMMETRICAL PULLUP	TOTAL	0.0	0.0	
298	<7750	0.0	0.0	
299	7750-8750	0.0	0.0	
300	>8750	0.0	0.0	
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0	
301	<7750	0.0	0.0	
302	7750-8750	0.0	0.0	
303	>8750	0.0	0.0	

SINS SPECTRUM USAGE

PAGE 7

AIRCRAFT: 76-22570. LOG TIME: 680.7 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1007 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 20-40X

A/S (VH)	TORQUE (PSI)				TOTAL	FLIGHT CONDITIONS
	<10	10	20	30		
<.5	0.0	0.0	0.3	0.5	0.8	124-129
PER 100 HRS	0.0	0.0	3.2	5.4	8.7	
.5						130-135
PER 100 HRS						
.7						136-141
PER 100 HRS						
.9						142-147
PER 100 HRS						
***TOTAL	0.0	0.0	0.3	0.5	0.8	
PER 100 HRS	0.0	2.2	3.2	5.4	8.7	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 40-60X

A/S (VH)	TORQUE (PSI)				TOTAL	FLIGHT CONDITIONS
	<10	10	20	30		
<.5	0.0	0.1	0.6	0.5	1.1	148-153
PER 100 HRS	0.3	0.8	5.9	4.8	11.9	
.5		0.0	0.5	2.2	2.6	154-159
PER 100 HRS		0.2	4.7	20.4	26.6	
.7		0.0	0.0	0.4	0.6	160-165
PER 100 HRS		0.0	0.1	4.6	6.4	
.9						166-171
PER 100 HRS						
***TOTAL	0.0	0.1	1.0	2.9	4.3	
PER 100 HRS	0.3	1.1	10.7	29.7	44.9	

SINS SPECTRUM USAGE

PAGE 8

AIRCRAFT: 76-22570. LOG TIME: 686.7 RETRIEVAL DATE: 28/ 6/80 REASON: SCHEDULED
 RECORDER: 1007 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION						
RUDDER POSITION: 60-80%						
A/S (VH)	<10	10	TORQUE (PSI)		30	40
			20	30	40	50
<.5	0.5	0.5	0.6	0.1	0.5	1.7
PER 100 HRS	5.4	5.0	5.0	1.5	0.0	17.8
.5	0.1	0.3	1.2	0.9	0.0	2.5
PER 100 HRS	0.6	3.4	12.5	9.1	0.3	25.9
.7	0.0	0.0	0.0	0.1	0.0	0.2
PER 100 HRS	0.0	0.0	0.2	1.2	0.4	1.7
.9						193-195
PER 100 HRS						
***TOTAL	0.6	0.8	1.8	1.1	0.1	4.4
PER 100 HRS	6.0	8.4	16.5	11.6	0.7	45.4

AIRSPEED VS TORQUE BY RUDDER POSITION						
RUDDER POSITION: 80-90%						
A/S (VH)	<10	10	TORQUE (PSI)		30	40
			20	30	40	50
<.5	0.0	0.0	0.0	0.0	0.1	0.1
PER 100 HRS	0.5	0.2	0.0	0.0	0.7	0.7
.5	0.0	0.0	0.0	0.0	0.0	0.0
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0
.7						208-213
PER 100 HRS						
.9						214-219
PER 100 HRS						
***TOTAL	0.0	0.0	0.0	0.0	0.1	0.1
PER 100 HRS	0.5	0.2	0.1	0.1	0.7	0.7

SINS SPECTRUM USAGE

PAGE 9

AIRCRAFT: 76-22578. LOG TIME: 688.7 RETRIEVAL DATE: 28/ 6/88 REASON: SCHEDULED
 RECORDER: 1987 BASE: 2
 DELTA LOG TIME: 12.8 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: >90X

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220-225
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	226-231
PER 100 HRS								232-237
PER 100 HRS								238-243
PER 100 HRS								
***TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

SINS SPECTRUM USAGE PAGE 10

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL PER 100 HOURS	RETRIEVAL PER 100 HOURS	
GUN TURN <.5 VH	TOTAL	0.0	0.0	
1	<7750	0.0	0.0	
2	7750-8750	0.0	0.0	
3	>8750	0.0	0.0	
GUN TURN .5-.7 VH	TOTAL	0.0	0.0	
4	<7750	0.0	0.0	
5	7750-8750	0.0	0.0	
6	>8750	0.0	0.0	
GUN TURN .7-.9 VH	TOTAL	0.0	0.0	
7	<7750	0.0	0.0	
8	7750-8750	0.0	0.0	
9	>8750	0.0	0.0	
GUN TURN >.9 VH	TOTAL	0.0	0.0	
10	<7750	0.0	0.0	
11	7750-8750	0.0	0.0	
12	>8750	0.0	0.0	
GUN S TURN <.5 VH	TOTAL	0.0	0.0	
13	<7750	0.0	0.0	
14	7750-8750	0.0	0.0	
15	>8750	0.0	0.0	
GUN S TURN .5-.7 VH	TOTAL	0.0	0.0	
16	<7750	0.0	0.0	
17	7750-8750	0.0	0.0	
18	>8750	0.0	0.0	
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0	
19	<7750	0.0	0.0	
20	7750-8750	0.0	0.0	
21	>8750	0.0	0.0	
GUN S TURN >.9 VH	TOTAL	0.0	0.0	
22	<7750	0.0	0.0	
23	7750-8750	0.0	0.0	
24	>8750	0.0	0.0	
HOVER <.3 VH	TOTAL	0.0	0.0	
25	<7750	0.0	0.0	
26	7750-8750	0.0	0.0	
27	>8750	0.0	0.0	
HOVER <.3 VH	TOTAL	0.0	0.0	
25	<7750	0.0	0.0	
26	7750-8750	0.0	0.0	
27	>8750	0.0	0.0	
CRUISE .3-.5 VH	TOTAL	0.1	0.9	
28	<7750	0.0	0.0	
29	7750-8750	0.1	0.9	
30	>8750	0.0	0.0	

SIRS SPECTRUM USAGE PAGE 11

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 20/ 6/80 RFASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
CRUISE .5-.6 VH	TOTAL	0.1	0.9	
31	<7750	0.0	0.0	
32	7750-8750	0.1	0.9	
33	>8750	0.0	0.0	
CRUISE .6-.7 VH	TOTAL	0.0	0.3	
34	<7750	0.0	0.0	
35	7750-8750	0.0	0.3	
36	>8750	0.0	0.0	
CRUISE .7-.8 VH	TOTAL	0.0	0.0	
37	<7750	0.0	0.0	
38	7750-8750	0.0	0.0	
39	>8750	0.0	0.0	
CRUISE .8-.9 VH	TOTAL	0.0	0.0	
40	<7750	0.0	0.0	
41	7750-8750	0.0	0.0	
42	>8750	0.0	0.0	
CRUISE .9-1.0 VH	TOTAL	0.0	0.0	
43	<7750	0.0	0.0	
44	7750-8750	0.0	0.0	
45	>8750	0.0	0.0	
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0	
46	<7750	0.0	0.0	
47	7750-8750	0.0	0.0	
48	>8750	0.0	0.0	
CRUISE >1.1 VH	TOTAL	0.0	0.0	
49	<7750	0.0	0.0	
50	7750-8750	0.0	0.0	
51	>8750	0.0	0.0	
CLIMB >.5 VH	TOTAL	0.0	0.3	
52	<7750	0.0	0.0	
53	7750-8750	0.0	0.3	
54	>8750	0.0	0.0	
DESCENT >.5 VH	TOTAL	0.3	2.9	
55	<7750	0.0	0.0	
56	7750-8750	0.3	2.9	
57	>8750	0.0	0.0	
ACCEL TO CLIMB	TOTAL	0.0	0.0	
58	<7750	0.0	0.0	
59	7750-8750	0.0	0.0	
60	>8750	0.0	0.0	

SIRS SPECTRUM USAGE

PAGE 12

AIRCRAFT: 76-22574. LOC TIME: 1120.8 RETRIEVAL DATE: 28/ 6/80 REASON: SCHEDULED
 RECORDER: 1905 BASE: 1
 DELTA LOC TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
FLARE	TOTAL			33.
61	<7750			302.
62	7750-8750			0.
63	>8750			0.
NZ PEAKS 1.1-1.3 G	TOTAL			1374.
64	<7750			12576
65	7750-8750			0.
66	>8750			12576.
NZ PEAKS 1.3-1.5 G	TOTAL			80.
67	<7750			732.
68	7750-8750			0.
69	>8750			732.
NZ PEAKS 1.5-1.7 G	TOTAL			5.
70	<7750			46.
71	7750-8750			0.
72	>8750			46.
NZ PEAKS >1.7 G	TOTAL			1.
73	<7750			0.
74	7750-8750			1.
75	>8750			0.
ROTOR CYCLES	TOTAL			146.
244				1336.
NORMAL LANDINGS	TOTAL			88.
245				805.
AUTOROATIVE LANDGS	TOTAL			158.
246				1464.
FLIGHT TIME	TOTAL	10.9	100.0	
267	<7750	0.0	0.0	
268	7750-8750	10.9	100.0	
269	>8750	0.0	0.0	
GROUND TIME	TOTAL	8.8	81.0	
270		8.0	81.0	
NORMAL TURN <.5 VH	TOTAL	0.0	0.2	
271	<7750	0.0	0.0	
272	7750-8750	0.0	0.2	
273	>8750	0.0	0.0	
NORMAL TURN .5-.7 VH	TOTAL	0.0	0.1	
274	<7750	0.0	0.0	
275	7750-8750	0.0	0.1	
276	>8750	0.0	0.0	

SINS SPECTRUM USAGE PAGE 13

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
NORMAL TURN .7-.9 VH	TOTAL	0.0	0.0	
277	<7750	0.0	0.0	
278	7750-8750	0.0	0.0	
279	>8750	0.0	0.0	
NORMAL TURN >.9 VH	TOTAL	0.0	0.0	
280	<7750	0.0	0.0	
281	7750-8750	0.0	0.0	
282	>8750	0.0	0.0	
AUTO TURNS NZ<1.5 G	TOTAL	0.0	0.2	
283	<7750	0.0	0.0	
284	7750-8750	0.0	0.2	
285	>8750	0.0	0.0	
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0	
286	<7750	0.0	0.0	
287	7750-8750	0.0	0.0	
288	>8750	0.0	0.0	
AUTOROTATIVE TIME	TOTAL	3.8	34.8	
289	<7750	0.0	0.0	
290	7750-8750	3.8	34.8	
291	>8750	0.0	0.0	
SYMMETRICAL DIVE	TOTAL	0.0	0.0	
292	<7750	0.0	0.0	
293	7750-8750	0.0	0.0	
294	>8750	0.0	0.0	
ASYMMETRICAL DIVE	TOTAL	0.0	0.0	
295	<7750	0.0	0.0	
296	7750-8750	0.0	0.0	
297	>8750	0.0	0.0	
SYMMETRICAL PULLUP	TOTAL	0.0	0.0	
298	<7750	0.0	0.0	
299	7750-8750	0.0	0.0	
300	>8750	0.0	0.0	
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0	
301	<7750	0.0	0.0	
302	7750-8750	0.0	0.0	
303	>8750	0.0	0.0	

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1895 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247 RPM PEAK VALUE 337.4
 248 TORQUE PEAK VALUE 62.0
 249 VL PEAK VALUE 0.6
 250 VH PEAK VALUE 0.7
 251 DENS ALT PEAK VALUE 3332.0
 252 W2 PEAK VALUE 1.7
 253 OAT MAXIMUM VALUE 34.0
 254 OAT MINIMUM VALUE 19.0
 255 GROSS WEIGHT PEAK 0.0
 256 ROLL PEAK VALUE 57.5

DENSITY ALTITUDE HISTOGRAM

	<1	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	0.0	1.7	9.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
PER 100 HRS	0.0	15.8	82.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
FLT COND MRS	304	305	306	307	308	309	310	311	312	313	314	

RPM HISTOGRAM

	<314	314	319	324	329	334	339	TOTAL
RETRIEVAL	0.4	0.3	6.4	3.8	0.0	0.0	0.0	10.9
PER 100 HRS	3.9	2.6	58.2	35.2	0.1	0.0	0.0	100.0
FLT COND MRS	315	316	317	318	319	320	321	

TORQUE HISTOGRAM

	<10	10	20	30	40	50	TOTAL
RETRIEVAL	3.8	3.0	3.2	0.2	0.0	0.0	10.9
PER 100 HRS	34.8	32.0	29.6	2.7	0.4	0.0	100.0
FLT COND MRS	322	323	324	325	326	327	

SIRS SPECTRUM USAGE

PAGE 15

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: <10°

A/S (VH)	<10	10	TORQUE (PSI)	30	40	50	TOTAL	FLIGHT CONDITIONS
PER 100 HRS	<.5							76- 81
PER 100 HRS	.5							82- 87
PER 100 HRS	.7							88- 93
PER 100 HRS	.9							94- 99
***TOTAL								
PER 100 HRS								

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 10-20°

A/S (VH)	<10	10	20	TORQUE (PSI)	30	40	50	TOTAL	FLIGHT CONDITIONS
PER 100 HRS	<.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100-105
PER 100 HRS	.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106-111
PER 100 HRS	.7								112-117
PER 100 HRS	.9								118-123
***TOTAL		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
PER 100 HRS		0.0	0.0	0.0	0.0	0.0	0.0	0.0	

SIRS SPECTRUM USAGE

PAGE 16

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1885 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 20-40%

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.3	0.3	0.4	0.1	0.0		1.0	124-129
PER 100 HRS	2.8	2.7	3.4	0.5	0.0		9.4	
.5								130-135
PER 100 HRS								
.7								136-141
PER 100 HRS								
.9								142-147
PER 100 HRS								
***TOTAL	0.3	0.3	0.4	0.1	0.0		1.0	
PER 100 HRS	2.8	2.7	3.4	0.5	0.0		9.4	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 40-60%

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.3	0.4	0.6	0.1	0.0	0.0	1.4	148-153
PER 100 HRS	3.0	3.0	5.1	0.6	0.1	0.0	12.4	
.5	0.0	0.0	0.0	0.0	0.0		0.1	154-159
PER 100 HRS	0.1	0.2	0.2	0.1			0.6	
.7								160-165
PER 100 HRS								
.9								166-171
PER 100 HRS								
***TOTAL	0.3	0.4	0.6	0.1	0.0	0.0	1.4	
PER 100 HRS	3.1	3.0	5.3	0.6	0.1	0.0	13.0	

SIRS SPECTRUM USAGE

PAGE 17

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 29/ 6/80 REASON: SCHEDULED
 RECORDER: 1905 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 60-00%

A/S (VE)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	1.7	1.4	1.0	0.1	0.0	0.0	4.2	172-177
PER 100 HRS	15.6	12.9	9.5	0.5	0.1	0.0	38.6	
.5	1.1	1.3	0.8	0.0	0.0		3.3	178-183
PER 100 HRS	10.1	11.8	7.5	0.4	0.1		29.9	
.7	0.0	0.0	0.0				0.0	184-189
PER 100 HRS	0.0	0.0	0.0				0.1	
.9								190-195
PER 100 HRS								
***TOTAL	2.8	2.7	1.9	0.1	0.0	0.0	7.5	
PER 100 HRS	20.0	24.7	17.0	0.9	0.2	0.0	<9.8	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 80-00%

A/S (VE)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.3	0.2	0.4	0.0	0.0	0.0	0.9	196-201
PER 100 HRS	2.6	1.5	3.5	0.2	0.1	0.0	7.8	
.5	0.0	0.0	0.0	0.0	0.0		0.1	202-207
PER 100 HRS	0.3	0.2	0.1	0.0	0.0		0.7	
.7								208-213
PER 100 HRS								
.9								214-219
PER 100 HRS								
***TOTAL	0.3	0.2	0.4	0.0	0.0	0.0	0.9	
PER 100 HRS	3.0	1.7	3.6	0.2	0.1	0.0	8.6	

SIMS SPECTRUM USAGE PAGE 18

AIRCRAFT: 76-22574. LOG TIME: 1120.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1005 BASE: 1
 DELTA LOG TIME: 21.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: >90%		AIRSPEED VS TORQUE BY RUDDER POSITION					TOTAL	FLIGHT CONDITIONS
A/S (VH)	<10	10	20	30	40	50		
<.5 PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	226-225
	0.0	0.0	0.2	0.0	0.0	0.0	0.3	
.5 PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	226-231
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
.7 PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	232-237
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
.9 PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	238-243
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
***TOTAL PER 100 HRS	0.0	0.0	0.2	0.0	0.0	0.0	0.3	

SIMS SPECTRUM USAGE

AIRCRAFT: 76-22569. LOG TIME: 1244.1 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1006 BASE: 1
 DELTA LOG TIME: 7.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE,

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
GUN TURN <.5 VH	TOTAL	0.0	0.0	0.0
1	<7750	0.0	0.0	0.0
2	7750-8750	0.0	0.0	0.0
3	>8750	0.0	0.0	0.0
GUN TURN .5-.7 VH	TOTAL	0.0	0.0	0.0
4	<7750	0.0	0.0	0.0
5	7750-8750	0.0	0.0	0.0
6	>8750	0.0	0.0	0.0
GUN TURN .7-.9 VH	TOTAL	0.0	0.0	0.0
7	<7750	0.0	0.0	0.0
8	7750-8750	0.0	0.0	0.0
9	>8750	0.0	0.0	0.0
GUN TURN >.9 VH	TOTAL	0.0	0.0	0.0
10	<7750	0.0	0.0	0.0
11	7750-8750	0.0	0.0	0.0
12	>8750	0.0	0.0	0.0
GUN S TURN <.5 VH	TOTAL	0.0	0.5	0.5
13	<7750	0.0	0.0	0.0
14	7750-8750	0.0	0.5	0.5
15	>8750	0.0	0.0	0.0
GUN S TURN .5-.7 VH	TOTAL	0.0	0.0	0.0
16	<7750	0.0	0.0	0.0
17	7750-8750	0.0	0.0	0.0
18	>8750	0.0	0.0	0.0
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0	0.0
19	<7750	0.0	0.0	0.0
20	7750-8750	0.0	0.0	0.0
21	>8750	0.0	0.0	0.0
GUN S TURN >.9 VH	TOTAL	0.0	0.0	0.0
22	<7750	0.0	0.0	0.0
23	7750-8750	0.0	0.0	0.0
24	>8750	0.0	0.0	0.0
HOVER <.3 VH	TOTAL	1.1	35.9	35.9
25	<7750	0.0	0.0	0.0
26	7750-8750	1.1	35.9	35.9
27	>8750	0.0	0.0	0.0
CRUISE .3-.5 VH	TOTAL	0.4	11.6	11.6
28	<7750	0.0	0.0	0.0
29	7750-8750	0.4	11.6	11.6
30	>8750	0.0	0.0	0.0

SINS SPECTRUM USAGE

PAGE 20

AIRCRAFT: 76-22569. LOG TIME: 1244.1 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1006 BASE: 1
 DELTA LOG TIME: 7.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL PER 100 HOURS	RETRIEVAL PER 100 HOURS	
CRUISE .5-.6 VH	TOTAL	0.1	3.2	
31	<7750	0.0	0.0	
32	7750-8750	0.1	3.2	
33	>8750	0.0	0.0	
CRUISE .6-.7 VH	TOTAL	0.0	0.0	
34	<7750	0.0	0.0	
35	7750-8750	0.0	0.0	
36	>8750	0.0	0.0	
CRUISE .7-.8 VH	TOTAL	0.0	0.0	
37	<7750	0.0	0.0	
38	7750-8750	0.0	0.0	
39	>8750	0.0	0.0	
CRUISE .8-.9 VH	TOTAL	0.0	0.0	
40	<7750	0.0	0.0	
41	7750-8750	0.0	0.0	
42	>8750	0.0	0.0	
CRUISE .9-1.0 VH	TOTAL	0.0	0.0	
43	<7750	0.0	0.0	
44	7750-8750	0.0	0.0	
45	>8750	0.0	0.0	
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0	
46	<7750	0.0	0.0	
47	7750-8750	0.0	0.0	
48	>8750	0.0	0.0	
CRUISE >1.1 VH	TOTAL	0.0	0.0	
49	<7750	0.0	0.0	
50	7750-8750	0.0	0.0	
51	>8750	0.0	0.0	
CLIMB >.5 VH	TOTAL	0.0	0.4	
52	<7750	0.0	0.0	
53	7750-8750	0.0	0.4	
54	>8750	0.0	0.0	
DESCENT >.5 VH	TOTAL	0.0	0.5	
55	<7750	0.0	0.0	
56	7750-8750	0.0	0.5	
57	>8750	0.0	0.0	
ACCEL TO CLIMB	TOTAL	0.0	0.0	
58	<7750	0.0	0.0	
59	7750-8750	0.0	0.0	
60	>8750	0.0	0.0	

SINS SPECTROM USAGE

PAGE 21

AIRCRAFT: 76-22569. LOG TIME: 1244.1 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1906 BASE: 1
 DELTA LOG TIME: 7.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	CROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
FLARE	TOTAL		5.
61	<7750		158.
62	7750-8750		5.
63	>8750		0.
NZ PEAKS 1.1-1.3 G	TOTAL		0.
64	<7750		6332.
65	7750-8750		0.
66	>8750		6332.
NZ PEAKS 1.3-1.5 G	TOTAL		0.
67	<7750		285.
68	7750-8750		0.
69	>8750		285.
NZ PEAKS 1.5-1.7 G	TOTAL		0.
70	<7750		190.
71	7750-8750		0.
72	>8750		190.
NZ PEAKS >1.7 G	TOTAL		0.
73	<7750		253.
74	7750-8750		0.
75	>8750		253.
ROTOR CYCLES	TOTAL		0.
244			46.
NORMAL LANDINGS	TOTAL		46.
245			2858.
AUTOROTATIVE LANDINGS	TOTAL		65.
246			65.
FLIGHT TIME	TOTAL		26.
267		3.2	823.
268	<7750	0.0	823.
269	7750-8750	0.0	
	>8750	0.0	
GROUND TIME	TOTAL		
270		121.2	
		121.2	
NORMAL TURN <.5 VR	TOTAL		
271	<7750	0.0	
272	7750-8750	0.0	
273	>8750	0.0	
NORMAL TURN .5-.7 VR	TOTAL		
274	<7750	0.0	
275	7750-8750	0.0	
276	>8750	0.0	

AIRCRAFT: 76-22569. LOG TIME: 1244.1 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1806 BASE: 1
 DELTA LOG TIME: 7.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

PAGE 22

SIMS SPECTRUM USAGE

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIVAL PER 100 HOURS	OCCURRENCE RETRIVAL PER 100 HOURS
NORMAL TURN 7-.9 VE	TOTAL	0.0	0.0
277	<7750	0.0	0.0
278	7750-8750	0.0	0.0
279	>8750	0.0	0.0
NORMAL TURN >.9 VE	TOTAL	0.0	0.0
280	<7750	0.0	0.0
281	7750-8750	0.0	0.0
282	>8750	0.0	0.0
AUTO TURNS NZ<1.5 G	TOTAL	0.0	0.0
283	<7750	0.0	0.0
284	7750-8750	0.0	0.0
285	>8750	0.0	0.0
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0
286	<7750	0.0	0.0
287	7750-8750	0.0	0.0
288	>8750	0.0	0.0
AUTONOTATIVE TIME	TOTAL	0.2	5.2
289	<7750	0.0	0.0
290	7750-8750	0.2	5.2
291	>8750	0.0	0.0
SYMMETRICAL DIVE	TOTAL	0.0	0.0
292	<7750	0.0	0.0
293	7750-8750	0.0	0.0
294	>8750	0.0	0.0
ASYMMETRICAL DIVE	TOTAL	0.0	0.1
295	<7750	0.0	0.0
296	7750-8750	0.0	0.1
297	>8750	0.0	0.0
SYMMETRICAL PULLUP	TOTAL	0.0	0.0
298	<7750	0.0	0.0
299	7750-8750	0.0	0.0
300	>8750	0.0	0.0
ASYMMETRICAL PULLUP	TOTAL	0.0	1.0
301	<7750	0.0	0.0
302	7750-8750	0.0	0.4
303	>8750	0.0	0.0

SIRS SPECTRUM USAGE PAGE 23

AIRCRAFT: 76-22500. LOG TIME: 1244.1 RETRIEVAL DATE: 28/ 6/88 REASON: SCHEDULED
 RECORDER: 1886 BASE: 1
 DELTA LOG TIME: 7.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247 RPM PEAK VALUE 329.6
 248 TORQUE PEAK VALUE 88.2
 249 VI PEAK VALUE 0.5
 250 VN PEAK VALUE 0.7
 251 DENS ALT PEAK VALUE 4414.9
 252 WZ PEAK VALUE 2.1
 253 OAT MAXIMUM VALUE 36.5
 254 OAT MINIMUM VALUE 22.0
 255 GROSS WEIGHT PEAK 6.0
 256 ROLL PEAK VALUE 58.4

DENSITY ALTITUDE HISTOGRAM

	<1	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	0.0	0.4	2.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
PER 100 HRS	0.0	11.5	65.1	23.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0
FLT COND HRS	304	305	306	307	308	309	310	311	312	313	314	

RPM HISTOGRAM

	<314	314	319	324	329	334	339	TOTAL
RETRIEVAL	0.0	0.0	1.5	1.6	0.0	0.0	0.0	3.2
PER 100 HRS	1.0	0.3	47.7	51.1	0.0	0.0	0.0	10.0
FLT COND HRS	315	316	317	318	319	320	321	

TORQUE HISTOGRAM

	<10	10	20	30	40	50	TOTAL
RETRIEVAL	0.2	0.0	1.2	0.0	0.2	0.0	3.2
PER 100 HRS	5.2	27.2	36.5	24.1	5.0	0.0	100.0
FLT COND HRS	322	323	324	325	326	327	

SBS SPECTRUM USAGE PAGE 24

AIRCRAFT: 76-22569. LOG TIME: 1244.1 RETRIEVAL DATE: 28/ 6/88 REASON: SCHEDULED
 RECORDER: 1806 BASE: 1
 DELTA LOG TIME: 7.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION						
RUDDER POSITION: <10°						
A/S (VH)	<10	TORQUE (PSI)	30	40	50	TOTAL
<.5						
PER 100 HRS						76- 81
.5						
PER 100 HRS						82- 87
.7						
PER 100 HRS						88- 93
.9						
PER 100 HRS						94- 99
***TOTAL						
PER 100 HRS						

AIRSPEED VS TORQUE BY RUDDER POSITION							
RUDDER POSITION: 10-20°							
A/S (VH)	<10	10	TORQUE (PSI) 20	30	40	50	FLIGHT CONDITIONS
<.5							100-105
PER 100 HRS					0.0 0.0		0.0 0.0
.5							106-111
PER 100 HRS							
.7							112-117
PER 100 HRS							
.9							118-123
PER 100 HRS							
***TOTAL							0.0
PER 100 HRS					0.0 0.0		0.0 0.0

SIMS SPECTRUM USAGE PAGE 25

AIRCRAFT: 76-22569. LOG TIME: 1244.1 RETRIEVAL DATE: 28/ 6/88 EFASON: SCHEDULED
 RECORDER: 1006 BASE: 1
 DELTA LOG TIME: 7.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION						
RUDDER POSITION: 28-40%						
A/S (VH)	10	20	30	40	50	FLIGHT CONDITIONS
<.5	0.1	0.4	0.2	0.1		124-129
PER 100 HRS	1.9	11.4	6.5	2.2		21.9
.5						130-135
PER 100 HRS						
.7						136-141
PER 100 HRS						
.9						142-147
PER 100 HRS						
***TOTAL	0.1	0.4	0.2	0.1		0.7
PER 100 HRS	1.9	11.4	6.5	2.2		21.9

AIRSPEED VS TORQUE BY RUDDER POSITION						
RUDDER POSITION: 40-60%						
A/S (VH)	10	20	30	40	50	FLIGHT CONDITIONS
<.5	0.1	0.2	0.2	0.0		148-153
PER 100 HRS	3.4	5.0	7.6	1.5		18.4
.5		0.0	0.0	0.0		154-159
PER 100 HRS		0.3	0.5	0.1		0.9
.7		0.0				160-165
PER 100 HRS		0.0				0.0
.9						166-171
PER 100 HRS						
***TOTAL	0.0	0.2	0.3	0.0		0.6
PER 100 HRS	3.4	6.2	8.1	1.6		19.3

RECORD: 1006
RETRIEVAL DATE: 28/ 6/80
REASON: SCHEDULED

RUDDER POSITION: 60-80%

	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
PER 100 HRS	0.2	0.6	0.2	0.0	0.0	1.6	172-177
	4.9	18.2	7.3	0.3		52.0	
PER 100 HRS	0.0	0.1	0.1	0.0	0.0	0.2	178-183
	0.4	2.0	2.3	0.9	0.0	5.5	
PER 100 HRS		0.0				0.0	184-189
		0.0				0.0	
PER 100 HRS							190-195

RUDDER POSITION: 80-90%

	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
PER 100 HRS	0.2	0.0	0.0	0.2	0.0		0.0	196-201
PER 100 HRS			0.5	0.1	0.1		1.1	
PER 100 HRS								202-207
PER 100 HRS								208-213
PER 100 HRS								214-219
PER TOTAL	0.0	0.0	0.0	0.0	0.0		0.0	
PER 100 HRS	0.2	0.2	0.5	0.1	0.1		1.1	

SIRS SPECTRUM USAGE

PAGE 27

AIRCRAFT: 76-22569. LOG TIME: 1244.1 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1006 BASE: 1
 DELTA LOG TIME: 2.7 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: >90X

A/S (VH)	<10	10	TORQUE (PSI)	30	40	50	TOTAL	FLIGHT CONDITIONS
PER 100 HRS	<.5							220-225
PER 100 HRS	.5							226-231
PER 100 HRS	.7							232-237
PER 100 HRS	.9							238-243
***TOTAL								
PER 100 HRS								

SIRS SPECTRUM USAGE

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 29/ 6/80 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: -098.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIVAL PER 100 HOURS	OCCURRENCE RETRIVAL PER 100 HOURS
GUN TURN <.5 VH	TOTAL	0.0	0.0
1	<7750	0.0	0.0
2	7750-8750	0.0	0.0
3	>8750	0.0	0.0
GUN TURN .5-.7 VH	TOTAL	0.0	0.0
4	<7750	0.0	0.0
5	7750-8750	0.0	0.0
6	>8750	0.0	0.0
GUN TURN .7-.9 VH	TOTAL	0.0	0.0
7	<7750	0.0	0.0
8	7750-8750	0.0	0.0
9	>8750	0.0	0.0
GUN TURN >.9 VH	TOTAL	0.0	0.0
10	<7750	0.0	0.0
11	7750-8750	0.0	0.0
12	>8750	0.0	0.0
GUN S TURN <.5 VH	TOTAL	0.0	0.0
13	<7750	0.0	0.0
14	7750-8750	0.0	0.0
15	>8750	0.0	0.0
GUN S TURN .5-.7 VH	TOTAL	0.8	0.2
16	<7750	0.8	0.2
17	7750-8750	0.0	0.0
18	>8750	0.0	0.0
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0
19	<7750	0.0	0.0
20	7750-8750	0.0	0.0
21	>8750	0.0	0.0
GUN S TURN >.9 VH	TOTAL	0.0	0.0
22	<7750	0.0	0.0
23	7750-8750	0.0	0.0
24	>8750	0.0	0.0
HOVER <.3 VH	TOTAL	0.5	0.1
25	<7750	0.5	0.1
26	7750-8750	0.0	0.0
27	>8750	0.0	0.0
CRUISE .3-.5 VH	TOTAL	0.9	0.2
28	<7750	0.0	0.0
29	7750-8750	0.5	0.1
30	>8750	0.5	0.1

SIRS SPECTRUM USAGE

PAGE 29

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 28/ 6/80 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: -898.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
CRUISE .5-.6 VH	TOTAL	9.4	2.0
31	<7750	0.5	0.1
32	7750-8750	8.7	1.8
33	>8750	0.2	0.0
CRUISE .6-.7 VH	TOTAL	0.0	0.0
34	<7750	0.0	0.0
35	7750-8750	0.0	0.0
36	>8750	0.0	0.0
CRUISE .7-.8 VH	TOTAL	0.9	0.2
37	<7750	0.7	0.1
38	7750-8750	0.0	0.0
39	>8750	0.2	0.0
CRUISE .8-.9 VH	TOTAL	1.1	0.2
40	<7750	0.5	0.1
41	7750-8750	0.7	0.1
42	>8750	0.0	0.0
CRUISE .9-1.0 VH	TOTAL	0.7	0.1
43	<7750	0.0	0.0
44	7750-8750	0.5	0.1
45	>8750	0.2	0.0
CRUISE 1.0-1.1 VH	TOTAL	11.4	2.4
46	<7750	0.5	0.1
47	7750-8750	0.5	0.1
48	>8750	10.5	2.2
CRUISE >1.1 VH	TOTAL	0.0	0.0
49	<7750	0.0	0.0
50	7750-8750	0.0	0.0
51	>8750	0.0	0.0
CLIMB >.5 VH	TOTAL	0.7	0.1
52	<7750	0.5	0.1
53	7750-8750	0.2	0.0
54	>8750	0.0	0.0
DESCENT >.5 VH	TOTAL	0.9	0.2
55	<7750	0.5	0.1
56	7750-8750	0.0	0.0
57	>8750	0.5	0.1
ACCEL TO CLIMB	TOTAL	0.5	0.1
58	<7750	0.0	0.0
59	7750-8750	0.0	0.0
60	>8750	0.5	0.1

SIRS SPECTRUM USAGE PAGE 30

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 28/ 6/80 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: -898.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS) RETRIEVAL PER 100 HOURS	OCCURRENCE RETRIEVAL PER 100 HOURS
FLARE	TOTAL	1028.	217.
61	<7750	512.	108.
62	7750-8750	2.	0.
63	>8750	514.	109.
NZ PEAKS 1.1-1.3 G	TOTAL	11786.	2490.
64	<7750	10762.	2274.
65	7750-8750	512.	108.
66	>8750	512.	108.
NZ PEAKS 1.3-1.5 G	TOTAL	0.	0.
67	<7750	0.	0.
68	7750-8750	0.	0.
69	>8750	0.	0.
NZ PEAKS 1.5-1.7 G	TOTAL	1028.	217.
70	<7750	512.	108.
71	7750-8750	514.	109.
72	>8750	2.	0.
NZ PEAKS >1.7 G	TOTAL	516.	109.
73	<7750	512.	108.
74	7750-8750	2.	0.
75	>8750	2.	0.
ROTOR CYCLES	TOTAL	511.	108.
244		511.	108.
NORMAL LANDINGS	TOTAL	0.	0.
245		0.	0.
AUTOROTATIVE LANDGS	TOTAL	1.	0.
246		1.	0.
FLIGHT TIME	TOTAL	473.3	100.4
267	<7750	3.7	0.8
268	7750-8750	466.0	98.5
269	>8750	3.6	0.8
GROUND TIME	TOTAL	465.9	98.4
270		465.9	98.4
NORMAL TURN <.5 VH	TOTAL	3.7	0.8
271	<7750	0.0	0.0
272	7750-8750	3.7	0.8
273	>8750	0.0	0.0
NORMAL TURN .5-.7 VH	TOTAL	0.0	0.0
274	<7750	0.0	0.0
275	7750-8750	0.0	0.0
276	>8750	0.0	0.0

SIRS SPECTRUM USAGE

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORD: 1002 BASE: 1
 DELTA LOG TIME: -898.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

PAGE 31

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL PER 100 HOURS	RETRIEVAL PER 100 HOURS	
NORMAL TURN .7-.9 VH	TOTAL	7.3	1.5	
277	<7750	0.0	0.0	
278	7750-8750	3.7	0.8	
279	>8750	3.6	0.8	
NORMAL TURN >.9 VH	TOTAL	0.0	0.0	
280	<7750	0.0	0.0	
281	7750-8750	0.0	0.0	
282	>8750	0.0	0.0	
AUTO TURNS N2<1.5 G	TOTAL	3.6	0.8	
283	<7750	3.6	0.8	
284	7750-8750	0.0	0.0	
285	>8750	0.0	0.0	
AUTO TURNS N2>1.5 G	TOTAL	3.7	0.8	
286	<7750	0.0	0.0	
287	7750-8750	3.6	0.8	
288	>8750	0.0	0.0	
AUTOPILOTATIVE TIME	TOTAL	7.3	1.5	
289	<7750	3.7	0.8	
290	7750-8750	3.6	0.8	
291	>8750	0.0	0.0	
SYMMETRICAL DIVE	TOTAL	3.7	0.8	
292	<7750	0.0	0.0	
293	7750-8750	3.7	0.8	
294	>8750	0.0	0.0	
ASYMMETRICAL DIVE	TOTAL	0.0	0.0	
295	<7750	0.0	0.0	
296	7750-8750	0.0	0.0	
297	>8750	0.0	0.0	
SYMMETRICAL PULLUP	TOTAL	7.3	1.5	
298	<7750	0.0	0.0	
299	7750-8750	3.7	0.8	
300	>8750	3.7	0.8	
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0	
301	<7750	0.0	0.0	
302	7750-8750	0.0	0.0	
303	>8750	0.0	0.0	

SINS SPECTRUM USAGE PAGE 32

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 28/ 6/86 REASON: SCHEDULED
 RECORDER: 1002 BASK: 1
 DELTA LOG TIME: -888.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

247 RPM PEAK VALUE 243.8
 248 TORQUE PEAK VALUE 0.0
 249 VL PEAK VALUE 0.0
 250 VH PEAK VALUE 0.0
 251 DENS ALT PEAK VALUE 0.0
 252 MZ PEAK VALUE -1.0
 253 OAT MAXIMUM VALUE -57.5
 254 OAT MINIMUM VALUE 70.0
 255 GROSS WEIGHT PEAK 0.0
 256 ROLL PEAK VALUE 0.0

DENSITY ALTITUDE HISTOGRAM

	<1	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	3.6	0.0	466.0	0.0	3.6	0.0	3.7	3.6	3.7	0.0	3.7	487.9
PER 100 HRS	0.8	0.0	98.5	0.0	0.8	0.0	0.8	0.8	0.8	0.0	0.8	103.1
FLT COND HRS	304	305	306	307	308	309	310	311	312	313	314	

RPM HISTOGRAM

	<314	314	319	324	329	334	339	TOTAL
RETRIEVAL	0.0	0.0	466.0	466.0	0.0	0.0	0.0	932.1
PER 100 HRS	0.0	0.0	98.5	98.5	0.0	0.0	0.0	196.9
FLT COND HRS	315	316	317	318	319	320	321	

TORQUE HISTOGRAM

	<10	10	20	30	40	50	TOTAL
RETRIEVAL	0.0	0.0	3.6	0.0	3.6	0.0	7.3
PER 100 HRS	0.0	0.0	0.8	0.0	0.8	0.0	1.5
FLT COND HRS	322	323	324	325	326	327	

SIMS SPECTROM USAGE PAGE 33
 AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 28/ 6/88 REASON: SCHEDULED
 RECORDER: 1992 BASE: 1
 DELTA LOG TIME: -698.9 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: <10%		TORQUE (PSI)				FLIGHT CONDITIONS	
A/S (VR)	<10	10	20	30	40	TOTAL	76- 81
<.5	0.0	0.1	0.1	0.1	7.8	1.7	8.3
PER 100 HRS	0.0	0.0	0.0	0.0	1.7	0.1	0.1
<.5	0.1	0.1	0.1	0.1	0.0	0.0	0.4
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.1
<.7	0.0	0.0	0.0	0.0	0.1	0.1	0.3
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.1
<.9	0.1	0.1	16.9	0.1	5.0	0.1	17.4
PER 100 HRS	0.0	0.0	3.0	0.0	0.0	0.0	3.7
---TOTAL	0.3	0.3	17.2	0.2	8.0	0.4	26.4
PER 100 HRS	0.1	0.1	3.0	0.0	1.7	0.1	5.0

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 10-20%		TORQUE (PSI)				FLIGHT CONDITIONS	
A/S (VR)	<10	10	20	30	40	TOTAL	100-105
<.5	0.1	0.1	0.0	0.0	0.1	0.1	0.4
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.1
<.5	0.0	0.1	0.1	0.1	0.1	0.2	0.7
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<.7	7.8	0.2	0.0	0.0	0.1	0.1	8.3
PER 100 HRS	1.7	0.0	0.0	0.0	0.0	0.0	1.0
<.9	0.1	0.1	0.1	0.0	0.0	0.1	0.6
PER 100 HRS	0.0	0.0	0.0	0.0	0.0	0.0	0.1
---TOTAL	0.1	0.6	0.3	0.1	0.4	0.4	10.6
PER 100 HRS	1.7	0.1	0.1	0.0	0.1	0.1	2.1

SIRS SPECTRUM USAGE

PAGE 34

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 20/ 6/80 BYASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: -008.6 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 20-40%

A/S (VR)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5		0.1	0.1	0.1	7.8	0.0	8.3	124-129
PER 100 HRS		0.0	0.0	0.0	1.7	0.0	1.7	
.5	0.1						0.1	130-135
PER 100 HRS	0.0						0.0	
.7						0.1	0.1	136-141
PER 100 HRS						0.0	0.0	
.9	0.1	0.1	7.8	0.1	0.1		8.4	142-147
PER 100 HRS	0.0	0.0	1.7	0.0	0.0		1.0	
***TOTAL	0.3	0.3	0.0	0.3	0.0	0.1	10.0	
PER 100 HRS	0.1	0.1	1.7	0.1	1.7	0.0	3.6	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 40-60%

A/S (VR)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5		0.1	0.1		0.0		0.4	148-153
PER 100 HRS		0.0	0.0		0.0		0.1	
.5		0.1	0.1	0.1	0.1	0.1	0.7	154-159
PER 100 HRS		0.0	0.0	0.0	0.0	0.0	0.2	
.7	7.8						7.8	160-165
PER 100 HRS	1.7			0.0			1.7	
.9								166-171
PER 100 HRS								
***TOTAL	8.0	0.3	0.3	0.1	0.1	0.1	9.0	
PER 100 HRS	1.7	0.1	0.1	0.0	0.0	0.0	1.9	

SIRS SPECTRUM USAGE

PAGE 33

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 28/ 6/80 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: -898.0 HOURS
 (##### INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 60-90°

A/S (VE)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	18.2	0.1	0.1	0.1	3.0	0.1	21.6	172-177
PER 100 HRS	3.8	0.0	0.0	0.0	0.6	0.0	4.6	
.5				0.1	0.0	0.1	0.3	178-183
PER 100 HRS				0.0	0.0	0.0	0.1	
.7			0.0				0.0	184-189
PER 100 HRS			0.0			0.0	0.0	
.9	0.1	0.1	3.0				3.3	190-195
PER 100 HRS	0.0	0.0	0.6				0.7	
***TOTAL	18.3	0.1	3.1	0.3	3.0	0.3	25.2	
PER 100 HRS	3.9	0.0	0.7	0.1	0.6	0.1	5.3	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 80-90°

A/S (VE)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5			0.0				0.0	196-201
PER 100 HRS			0.0				0.0	
.5					0.1	0.1	0.3	202-207
PER 100 HRS					0.0	0.0	0.1	
.7	2.4		0.0	0.0	0.1	0.1	2.7	208-213
PER 100 HRS	0.5		0.0	0.0	0.0	0.0	0.6	
.9	0.1	0.1	0.0				0.3	214-219
PER 100 HRS	0.0	0.0	0.0				0.1	
***TOTAL	2.6	0.1	0.0	0.0	0.3	0.3	3.3	
PER 100 HRS	0.5	0.0	0.0	0.0	0.1	0.1	0.7	

SRS SPECTRUM USAGE

PAGE 36

AIRCRAFT: 76-22568. LOG TIME: 0.0 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1002 BASE: 1
 DELTA LOG TIME: -898.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED IS TORQUE BY RUDDER POSITION

RUDDER POSITION: >90°

A/S (VH)	<10	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5 PER 100 HRS		2.1 0.0	0.1 0.0	0.1 0.0	0.7 0.2	0.1 0.0	1.3 0.3	220-225
.5 PER 100 HRS	0.1 0.0	0.1 0.0	0.1 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.1 0.0	220-231
.7 PER 100 HRS	0.0 0.0					0.0 0.0	0.0 0.0	232-237
.9 PER 100 HRS		0.0 0.0	0.1 0.0	0.0 0.0	0.1 0.0	0.1 0.0	0.4 0.1	238-243
***TOTAL PER 100 HRS	0.1 0.0	0.3 0.1	0.4 0.1	0.1 0.0	0.9 0.2	0.3 0.1	2.1 0.5	

SIRS SPECTRUM USAGE PAGE 37

AIRCRAFT: 76-22571. LOG TIME: 982.8 RETRIEVAL DATE: 28/ 6/86 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
GUN TURN <.5 VH	TOTAL	0.0	0.0	
1	<7750	0.0	0.0	
2	7750-8750	0.0	0.0	
3	>8750	0.0	0.0	
GUN TURN .5-.7 VH	TOTAL	0.0	0.0	
4	<7750	0.0	0.0	
5	7750-8750	0.0	0.0	
6	>8750	0.0	0.0	
GUN TURN .7-.9 VH	TOTAL	0.0	0.0	
7	<7750	0.0	0.0	
8	7750-8750	0.0	0.0	
9	>8750	0.0	0.0	
GUN TURN >.9 VH	TOTAL	0.0	0.0	
10	<7750	0.0	0.0	
11	7750-8750	0.0	0.0	
12	>8750	0.0	0.0	
GUN S TURN <.5 VH	TOTAL	0.0	0.0	
13	<7750	0.0	0.0	
14	7750-8750	0.0	0.0	
15	>8750	0.0	0.0	
GUN S TURN .5-.7 VH	TOTAL	0.0	0.0	
16	<7750	0.0	0.0	
17	7750-8750	0.0	0.0	
18	>8750	0.0	0.0	
GUN S TURN .7-.9 VH	TOTAL	0.0	0.0	
19	<7750	0.0	0.0	
20	7750-8750	0.0	0.0	
21	>8750	0.0	0.0	
GUN S TURN >.9 VH	TOTAL	0.0	0.0	
22	<7750	0.0	0.0	
23	7750-8750	0.0	0.0	
24	>8750	0.0	0.0	
HOVER <.3 VH	TOTAL	4.6	26.4	
25	<7750	0.0	0.0	
26	7750-8750	4.6	26.4	
27	>8750	0.0	0.0	
CRUISE .3-.5 VH	TOTAL	1.9	10.9	
28	<7750	0.0	0.0	
29	7750-8750	1.9	10.9	
30	>8750	0.0	0.0	

SIRS SPECTRUM USAGE PAGE 38

AIRCRAFT: 76-22571. LOG TIME: 982.8 RETRIEVAL DATE: 28/ 6/80 REASON: SCHEDULED
 RECORDER: 1073 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
CRUISE .5-.6 VH	TOTAL	2.3	13.2	
31	<7750	0.0	0.0	
32	7750-8750	2.3	13.2	
33	>8750	0.0	0.0	
CRUISE .6-.7 VH	TOTAL	0.3	2.0	
34	<7750	0.0	0.0	
35	7750-8750	0.3	2.0	
36	>8750	0.0	0.0	
CRUISE .7-.8 VH	TOTAL	0.0	0.1	
37	<7750	0.0	0.0	
38	7750-8750	0.0	0.1	
39	>8750	0.0	0.0	
CRUISE .8-.9 VH	TOTAL	0.0	0.0	
40	<7750	0.0	0.0	
41	7750-8750	0.0	0.0	
42	>8750	0.0	0.0	
CRUISE .9-1.0 VH	TOTAL	0.0	0.0	
43	<7750	0.0	0.0	
44	7750-8750	0.0	0.0	
45	>8750	0.0	0.0	
CRUISE 1.0-1.1 VH	TOTAL	0.0	0.0	
46	<7750	0.0	0.0	
47	7750-8750	0.0	0.0	
48	>8750	0.0	0.0	
CRUISE >1.1 VH	TOTAL	0.0	0.0	
49	<7750	0.0	0.0	
50	7750-8750	0.0	0.0	
51	>8750	0.0	0.0	
CLIMB >.5 VH	TOTAL	0.1	0.5	
52	<7750	0.0	0.0	
53	7750-8750	0.1	0.5	
54	>8750	0.0	0.0	
DESCENT >.5 VH	TOTAL	0.3	1.8	
55	<7750	0.0	0.0	
56	7750-8750	0.3	1.8	
57	>8750	0.0	0.0	
ACCEL TO CLIMB	TOTAL	0.0	0.0	
58	<7750	0.0	0.0	
59	7750-8750	0.0	0.0	
60	>8750	0.0	0.0	

SINS SPECTRUM USAGE

PAGE 30

AIRCRAFT: 76-22571. LOG TIME: 982.6 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORD: 1003 BASF: 1
 DELTA LOG TIME: 0.0 HOURS
 (##### INDICATES AN INVALID FLIGHT CONDITION VALUE)

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL PER 100 HOURS	RETRIEVAL PER 100 HOURS	
FLARE	TOTAL			6.
61	<7750			34.
62	7750-8750			2.
63	>8750			11.
				23.
				0.
NZ PEAKS 1.1-1.3 G	TOTAL			2.
64	<7750			0.
65	7750-8750			11.
66	>8750			2.
				0.
NZ PEAKS 1.3-1.5 G	TOTAL			1.
67	<7750			0.
68	7750-8750			1.
69	>8750			0.
				0.
NZ PEAKS 1.5-1.7 G	TOTAL			1.
70	<7750			0.
71	7750-8750			1.
72	>8750			0.
				0.
NZ PEAKS >1.7 G	TOTAL			1.
73	<7750			0.
74	7750-8750			1.
75	>8750			0.
				0.
ROTOR CYCLES	TOTAL			171.
244				979.
NORMAL LANDINGS	TOTAL			169.
245				968.
AUTOROTATIVE LANDGS	TOTAL			162.
246				928.
FLIGHT TIME	TOTAL	17.5	100.0	
267	<7750	0.0	0.0	
268	7750-8750	17.5	100.0	
269	>8750	0.0	0.0	
GROUND TIME	TOTAL	13.2	75.6	
270		13.2	75.6	
NORMAL TURN <.5 VH	TOTAL	0.0	0.1	
271	<7750	0.0	0.0	
272	7750-8750	0.0	0.1	
273	>8750	0.0	0.0	
NORMAL TURN .5-.7 VH	TOTAL	0.0	0.0	
274	<7750	0.0	0.0	
275	7750-8750	0.0	0.0	
276	>8750	0.0	0.0	

SINS SPECTRUM USAGE

AIRCRAFT: 76-22571. LOG TIME: 982.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

PAGE 40

FLIGHT CONDITION	GROSS WEIGHT (LB)	TIME (HOURS)		OCCURRENCE RETRIEVAL PER 100 HOURS
		RETRIEVAL	PER 100 HOURS	
NORMAL TURN .7-.9 VH	TOTAL	0.0	0.0	
277	<7750	0.0	0.0	
278	7750-8750	0.0	0.0	
279	>8750	0.0	0.0	
NORMAL TURN >.9 VH	TOTAL	0.0	0.0	
280	<7750	0.0	0.0	
281	7750-8750	0.0	0.0	
282	>8750	0.0	0.0	
AUTO TURNS NZ<1.5 G	TOTAL	0.0	0.0	
283	<7750	0.0	0.0	
284	7750-8750	0.0	0.0	
285	>8750	0.0	0.0	
AUTO TURNS NZ>1.5 G	TOTAL	0.0	0.0	
286	<7750	0.0	0.0	
287	7750-8750	0.0	0.0	
288	>8750	0.0	0.0	
AUTOROTATIVE TIME	TOTAL	0.8	4.5	
289	<7750	0.0	0.0	
290	7750-8750	0.8	4.5	
291	>8750	0.0	0.0	
SYMMETRICAL DIVE	TOTAL	0.0	0.0	
292	<7750	0.0	0.0	
293	7750-8750	0.0	0.0	
294	>8750	0.0	0.0	
ASYMMETRICAL DIVE	TOTAL	0.0	0.0	
295	<7750	0.0	0.0	
296	7750-8750	0.0	0.0	
297	>8750	0.0	0.0	
SYMMETRICAL PULLUP	TOTAL	0.0	0.0	
298	<7750	0.0	0.0	
299	7750-8750	0.0	0.0	
300	>8750	0.0	0.0	
ASYMMETRICAL PULLUP	TOTAL	0.0	0.0	
301	<7750	0.0	0.0	
302	7750-8750	0.0	0.0	
303	>8750	0.0	0.0	

AIRCRAFT: 76-22571. LOG TIME:
ORDER: 1023 BASE: 1
ETA LOG TIME: 0.0 HOURS

247	RPM PEAK VALUE	343.8
248	TORQUE PEAK VALUE	59.0
249	VL PEAK VALUE	0.6
250	VE PEAK VALUE	0.7
251	DENS AIR PEAK VALUE	408.7
252	NZ PEAK VALUE	1.9
253	OAT MAXIMUM VALUE	36.5
254	OAT MINIMUM VALUE	18.0
255	CROSS WEIGHT PEAK	0.0
256	ROLL PEAK VALUE	54.3

DENSITY ALTITUDE HISTOGRAM
ALTITUDE (K FT)

	1	2	3	4	5	6	7	8	9	10	TOTAL
RETRIEVAL	0.0	11.5	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5
PER 100 HRS	0.0	65.7	25.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	100.0
FLT COND NES	394	306	307	308	309	310	311	312	313	314	

RPM HISTOGRAM RPM

	<314	314	319	324	329	334	339	TOTAL
RETRIVAL	0.2	0.1	12.0	5.1	0.0	0.0	0.0	17.5
PER 100 HRS	1.3	0.6	68.7	29.1	0.2	0.1	0.0	100.0
FLY COND MES	315	316	317	318	319	320	321	

**TORQUE HISTOGRAM
TORQUE (PSI)**

	<10	10	20	30	40	50	TOTAL
RETRIVAL	0.8	3.1	7.3	6.1	0.1	0.0	17.5
PER 100 HRS	4.5	18.0	41.7	35.5	0.3	0.0	100.0
YLT COND HRS	322	323	324	325	326	327	

SIRS SPECTRUM USAGE

PAGE 42

AIRCRAFT: 76-22571. LOG TIME: 982.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: <10%		TORQUE (PSI)		TOTAL		FLIGHT
A/S (VH)	<10	10	20	30	40	CONDITIONS
<.5						76- 81
PER 100 HRS						
.5						82- 87
PER 100 HRS						
.7						88- 93
PER 100 HRS						
.9						94- 99
PER 100 HRS						
***TOTAL						
PER 100 HRS						

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 10-20%		TORQUE (PSI)		TOTAL		FLIGHT
A/S (VH)	<10	10	20	30	40	CONDITIONS
<.5						100-105
PER 100 HRS						
.5						106-111
PER 100 HRS						
.7						112-117
PER 100 HRS						
.9						118-123
PER 100 HRS						
***TOTAL						
PER 100 HRS						

SIRS SPECTRUM USAGE

PAGE 43

AIRCRAFT/ 76-22571. LOG TIME: 982.8 RETRIEVAL DATE: 28/ 6/80 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DATA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 28-46%

A/S (VH)	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.0	0.0	0.2	0.0		0.2	124-129
PER 100 HRS	0.0	0.0	1.1	0.0		1.1	
.5							130-135
PER 100 HRS							
.7							136-141
PER 100 HRS							
.9							142-147
PER 100 HRS							
****TOTAL	0.0	0.0	0.2	0.0		0.2	
PER 100 HRS	0.0	0.0	1.1	0.0		1.1	

AIRSPEED VS TORQUE BY RUDDER POSITION

RUDDER POSITION: 48-60%

A/S (VH)	10	20	30	40	50	TOTAL	FLIGHT CONDITIONS
<.5	0.0	0.5	2.6	0.0		3.2	148-153
PER 100 HRS	0.0	2.7	15.1	0.1		18.2	
.5							154-159
PER 100 HRS							
.7							160-165
PER 100 HRS							
.9							160-171
PER 100 HRS							
****TOTAL	0.0	0.5	2.6	0.0		3.2	
PER 100 HRS	0.0	2.7	15.1	0.1		18.2	

SINS SPECTRUM USAGE PAGE 45

AIRCRAFT: 76-22571. LOG TIME: 982.8 RETRIEVAL DATE: 20/ 6/80 REASON: SCHEDULED
 RECORDER: 1003 BASE: 1
 DELTA LOG TIME: 0.0 HOURS
 (***** INDICATES AN INVALID FLIGHT CONDITION VALUE)

RUDDER POSITION: >90X		AIRSPEED VS TORQUE BY RUDDER POSITION					FLIGHT CONDITIONS
A/S (VH)	<10	10	20	30	40	50	
<.5 PER 100 HRS	0.6	1.0	0.2	0.0			1.8
	3.4	5.5	1.1	0.1			10.1
.5 PER 100 HRS	0.0	0.0	0.1	0.0			0.2
	0.2	0.3	0.4	0.1			0.9
.7 PER 100 HRS							232-237
.9 PER 100 HRS							238-243
***TOTAL PER 100 HRS	0.6	1.0	0.3	0.0			1.9
	3.6	5.7	1.5	0.2			11.6

